This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

REPORT

OF THE

SECRETARY OF WAR;

BEING PART OF

THE MESSAGE AND DOCUMENTS

COMMUNICATED TO THE

TWO HOUSES OF CONGRESS

AT THE

BEGINNING OF THE SECOND SESSION OF THE FIFTIETH CONGRESS.

IN FOUR VOLUMES.

VOLUME II.
PART 4.

WASHINGTON:
GOVERNMENT PRINTING OFFICE.
1888.

LIBRARY
OF THE
LELAND STANFORD JUNIOR
UNIVERSITY

A. 1122.

CONTENTS.

habetical index will be found at the end of each part.]

PART I.

Corps of Engineers 3

A-COAST AND LAKE FRONTIER DEFENSES.

ON 4
PROPRIATIONS FOR 1889-'90 5

THE BOARD OF ENGINEERS.

ting Board, 5; Subjects considered and reported upon, 6; Additional ies of individual members, 6; Sea-coast fortifications, 8.

POS ILLETS POINT, ENGINEER SCHOOL OF APPLICATION, BATTALION OF ENGINEERS, AND ENGINEER DEPOT AT WILLETS POINT, NEW YORK HARBOR.

Post of Willets Point, School of Application, Battalion of Engineers, 8; Experiments, Engineer Depot, Public Buildings and Construction, Statement of Funds, 9.

RIVER AND HARBOR IMPROVEMENTS.

General Statement 10

ATLANTIC COAST AND GULF OF MEXICO.

In charge of Lieut. Col. Jared A. Smith, Corps of Engineers—

Lubec Channel, Me., Moose-a-bec Bar, Me., 11; Narraguagus River, Me., 12; breakwater from Mount Desert to Porcupine Island, Me., Bagaduce River, Me., Bangor Harbor and Penobscot River, Me., 13; Belfast Harbor, Me., Camden Harbor, Me., 14; Rockport Harbor, Me., Rockland Harbor, Me., 15; Kennebec River at Bath, and from Augusta to lower end of Perkins Island, Me., Portland Harbor, Me., 16; channel in Back Cove, Portland, Me., 17; breakwater at mouth of Saco River, Me., Saco River, Me., 18; Kennebunk River, Me., York Harbor, Me., 19; Portsmouth Harbor, N. H., Bellamy River, N. H., Cocheco River, N. H., 20; harbor of refuge, at Little Harbor, N. H., 21; examinations and surveys, 22.

In charge of Lieut. Col. George L. Gillespie, Corps of Engineers—

Newburyport Harbor, Mass., 22; Merrimac River, Mass., 23; Powow river, Mass., Ipswich River, Mass., 24; harbor of refuge, Sandy Bay, Cape Ann, Mass., Gloucester Harbor, Mass., 25; Manchester Harbor, Mass., Lynn Harbor, Mass., 26; Winthrop Harbor, Mass., Boston Harbor, Mass., 27; Malden River, Mass., Hingham Harbor, Mass., 29; Scituate Harbor, Mass., 30; Plymouth Harbor, Mass., Wellfleet Harbor, Mass., 31; Provincetown Harbor, Mass., examinations and surveys, 32.

IN CHARGE OF MAJ. WILLIAM R. LIVERMORE, CORPS OF ENGINEERS—

Harbor of refuge at Hyannis, Mass., harbor of refuge at Nantucket, Mass., 33; harbor at Vineyard Haven, Mass., Wood's Holl Harbor, Mass., 34; Wareham Harbor, Mass., 35; New Bedford Harbor, Mass., Westport Harbor, Mass., 36; Taunton River, Mass., 37; Warren River, R. I., Pawtucket River, R. I., 38; Providence River and Narragansett Bay, R. I., 39; removal of Green Jacket Shoal, Providence River, R. I., Newport Harbor, R. I., 40; harbor of refuge at Block Island, R. I., 41; Pawcatuck River, R. I. and Conn., harbor of refuge at Stonington, Conn., 43; examinations and surveys, 44.

IN CHARGE OF LIEUT. COL. D. C. HOUSTON, CORPS OF ENGINEERS—

Thames River, Conn.; New London Harbor, Conn., 45; Connecticut River, Mass. and Conn., 46; Clinton Harbor, Conn., 47; New Haven Harbor, Conn., breakwater at New Haven, Conn., 48; Milford Harbor, Conn., 49; Housatonic River, Conn., Bridgeport Harbor, Conn., 50; Black Rock Harbor, Conn., Norwalk Harbor, Conn., 51; Harbor at Five-mile River, Conn., Stanford Harbor, Conn., 52; Port Chester Harbor, N. Y., Mamaroneck Harbor, N. Y., 53; Echo Harbor, New Rochelle, N. Y., New Rochelle Harbor, N. Y., 54; East Chester Creek, N. Y., Greenport Harbor, N. Y., 55; Glen Cove Harbor, N. Y., Flushing Bay, N. Y., 56; removing sunken vessels or craft obstructing or endangering navigation, 57.

IN CHARGE OF LIEUT. COL. WALTER MCFARLAND, CORPS OF ENGINEERS—

Hudson River, N. Y., 57; harbor at Saugerties, N. Y., harbor at Rondout, N. Y., 58; Harlem River, N. Y., 59; removing obstructions in the East River and at Hell Gate, N. Y., 60; Newtown Creek, N. Y., Buttermilk Channel New York Harbor, 61; Gowanus Bay, N. Y., 62; New York Harbor, 63; Sheepshead Bay, N. Y., 64; Canarsie Bay, N. Y., 65; Sumpawanus Inlet, N. Y., channel between Staten Island and New Jersey, 66; Raritan Bay, N. J., removing sunken vessels or craft obstructing or endangering navigation, 67; examinations and survey, 67 and 68.

IN CHARGE OF CAPT. GEORGE MCC. DERBY, CORPS OF ENGINEERS—

Passaic River, N. J., 68; Elizabeth River, N. J., 69; Rahway River, N. J., 70; Woodbridge Creek, N. J., Raritan River, N. J., 71; South River, N. J., 72; Cheesequakes Creek, N. J., Keyport Harbor, N. J., 73; Mattawan Creek, N. J., Shrewsbury River, N. J., 74; Manasquan River, N. J., 75.

IN CHARGE OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS—

Delaware River, Pa. and N. J., 76; Frankford Creek, Pa., 77; harbor of Philadelphia, removal of Smith's Island and Windmill Island, Pa., and Petty's Island, N. J., Schuylkill River, Pa., 78; ice-harbor at Marcus Hook, Pa., 79; ice-harbor at the head of Delaware Bay, Del., 80; construction of iron pier in Delaware Bay, near Lewes, Del., harbor at Delaware Breakwater, Del., 81; Rancocas River, N. J., 82; Woodbury Creek, N. J., Mantua Creek, N. J., 83; Raccoon River, N. J., Salem River, N. J., Cohansey Creek, N. J., 84; removal of wrecks from Delaware Bay and River, removing sunken vessels or craft obstructing or endangering navigation, survey of harbor at Atlantic City, N. J., 85; United States Commission advisory to the Board of Harbor Commissioners of Philadelphia, Pa., 86; examination and survey, 86.

IN CHARGE OF MR. WILLIAM F. SMITH, U. S. AGENT—

Maurice River, N. J., 86; Wilmington Harbor, Del., 87; ice-harbor at New Castle, Del., Duck Creek, Del., 88; Saint Jones River, Del., 89; Mispillion Creek, Del., Broadkiln River, Del., Indian River, Del., 90; inland water-way from Chincoteague Bay, Va. to Delaware Bay at or near Lewes, Del., Susquehanna River above and below Havre de Grace, Md., 91; Fairlee Creek or Inlet, Md., Corsica Creek, Md., 92; Choptank River, Md., Cambridge Harbor, Md., 93; Nanticoke River, Del., Broad Creek, Del., from its mouth to Laurel, 94; Pocomoke River, Md, removing sunken vessels or craft obstructing or endangering navigation, 95.

IN CHARGE OF COL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS—

Patapsco River and Channel to Baltimore, Md., 95; James River, Va., 97; Nansemond River, Va., including the mouths of Bennett and Chuckatuck creeks, harbor of Norfolk and its approaches, Va., 98; approach to Norfolk Harbor and the United States (Norfolk) navy-yard, between Lambert's Point and Fort Norfolk, Va., 99; Archer's Hope River, Va., Appomattox River, Va., 101; Currituck Sound, Coanjok Bay, and North River Bar, N. C., 102; Nottoway River, Va., 103; removing sunken vessels or craft obstructing or endangering navigation, 104.

In charge of Lieut. Col. Peter C. Hains, Corps of Engineers—

Potomac River at Washington, D. C., 104; reconstruction of the Aqueduct Bridge, Georgetown, D. C.; bridge across the Eastern Branch of the Potomac River, D. C., 106; wharf at Fort Monroe, Va., 107; survey, 107.

In charge of Mr. S. T. Abert, U. S. Agent—

Channel at Mount Vernon, Va., Neabsco Creek, Va., 108; Breton Bay (Leonardtown) Md., Nomini Creek, Va., 109; harbor at entrance of St. Jerome's Creek, Md., Patuxent River, Md. from Benedict to Hill's Landing, 110; Rappahannock River, Va., Totusky River, Va., 111; Urbana Creek, Va., Mattaponi River, Va., Pamunky River, Va., 112; York River, Va., 113; Chickahominy River, Va., Staunton River, Va., 114; Dan River between Madison, N. C., and Danville, Va., Roanoke River, N. C., 115; French Broad River, N. C., removing sunken vessels or craft obstructing or endangering navigation, 116; examination and survey, 116.

In charge of Capt. William H. Bixby, Corps of Engineers—

Pamlico and Tar rivers, N. C., Contentnia Creek, N. C., 117; Trent River, N. C., 118; Neuse River, N. C., 119; inland water-way between New Berne and Beaufort, N. C., 120; harbor at Beaufort, N. C., 121; inland water-way between Beaufort Harbor and New River, N. C. 122; New River, N. C., Black River, N. C., 123; Cape Fear River, N. C., 124 and 125; Waccamaw River, N. C. and S. C., 126; Yadkin River, N. C., 127; Little Pee Dee River, S. C., Lumber River, N. C., Clark Creek or River, S. C., 128; Great Pee Dee River, S. C., harbor at Georgetown, S. C., 129; Mingo Creek or River, S. C., Winyaw Bay, S. C., 130; Santee River, S. C., 131; Wateree River, S. C., 132; Congaree River, S. C., 133; examinations and surveys, 134.

In charge of Lieut. Frederic V. Abbot, Corps of Engineers—

Charleston Harbor, S. C., 134; Wappoo Cut, S. C., 135; Ashley River, S. C., Edisto River S. C., 136; Salkiehatchie River, S. C., 137; removing sunken vessels or craft obstructing or endangering navigation, 138; examinations and surveys, 138.

In charge of Lieut. O. M. Carter, Corps of Engineers—

Savannah Harbor and River, Ga., 138; Savannah River, Ga., 139; Savannah River above Augusta, Ga., Romley Marsh, Ga., 140; Altamaha River, Ga., Doboy Bar, Ga., 141; Brunswick Harbor, Ga., Jekyl Creek, Ga., Cumberland Sound, Ga. and Fla., 142; examinations and surveys, 143.

In charge of Capt. Wm. M. Black, Corps of Engineers—

St. John's River, Fla., 143; Volusia Bar, Fla., harbor at Saint Augustine, Fla., 145; northwest entrance Key West Harbor, Fla., Caloosahatchie River, Fla., 146; Pease River, Fla., Manatee River, Fla., 147; Tampa Bay, Fla., 148; Withlacoochee River, Fla., harbor at Cedar Keys, Fla., 149; Suwanee River, Fla., 150; removing sunken vessels or craft obstructing or endangering navigation, 151; examinations and surveys, 151.

In charge of Capt. R. L. Hoxie, Corps of Engineers—

Apalachicola River, Fla., 151; Apalachicola Bay, Fla., La Grange Bayou, Fla., Pensacola Harbor, Fla., 152; Choctawhatchee River, Fla. and Ala., Escambia and Conecuh Rivers, Fla., and Ala., 153; Oconee River, Ga., 154; Ocmulgee River, Ga., Flint River, Ga., 155; Coosa River, Ga., and Ala. Chattahoochee River, Ga. and Ala., Tallapoosa River, Ala, 156; Cahawba River, Ala, 157; Alabama River, Ala., removing sunken vessels and craft obstructing or endangering navigation, 158; examinations and surveys, 159.

In charge of Major A. N. Damrell, Corps of Engineers—

Mobile Harbor, 159; Black Warrior River from Tuscaloosa to Daniel's Creek, Ala., Warrior, River, Ala., and Miss., 160; Tombigbee River, Ala., from Walker's bridge to Fulton, Tombigbee River from Fulton to Vienna, 161; Tombigbee River, below Vienna, 162; Noxubee River, Miss., Pascagoula River, Miss., 163; Harbor at Biloxi, Miss., Pearl River, Miss. between Edinburgh and Carthage, 164; Pearl River, Miss. from Jackson to Carthage, Pearl River, Miss. below Jackson, 165; examination and survey, 166.

In charge of Capt. W. L. Fisk, Corps of Engineers—

Inspection of the improvement of the South Pass of the Mississippi River, 166; Tchefuncte River and Bogue Falia, La., Tickfaw River, La., 167; Amite River, La., Bayou La Fourche, La., 168; Bayou Terrebonne, La., Bayou Plaquemine, La., 169; Bayou Courtableau, La., 170; Calcasieu River and Pass, La., Bayou Pierre, Miss., 171; Sabine Pass, Tex., 172.

In charge of Maj. O. H. Ernst, Corps of Engineers—

Entrance to Galveston Harbor, Tex., 172; Ship-channel in Galveston Bay, Tex., 173; Trinity River, Tex., Buffalo Bayou, Tex., 174; mouth of Brazos River, Tex., Pass Cavallo Inlet to Matagorda Bay, Tex., Aransas Pass and Bay up to Rockport and Corpus Christi, Tex., 175; harbor at Brazos Santiago, Tex., 176.

WESTERN RIVERS.

In charge of Capt. J. H. Willard, Corps of Engineers—

Red River, La. and Ark., 176; survey of Red River, Cypress Bayou, Tex. and La., 177; Ouachita and Black Rivers, Ark. and La., Ouachita River, Ark. above Camden, Bayou D'Arbonne, La., 178; Little River, La., Bayou Bartholomew, La. and Ark., Bayou Bœuf, La., 179; Tensas River and Bayou Macon, La., Bayous Rondeway and Vidal, La. by removing obstructions, 180; Big Black River, Miss., Yazoo River, Miss., Tchula Lake, Miss., 181; Tallahatchee River, Miss., Steele's Bayou, Miss., 182; Big Sunflower River, Miss., Big Hatchee River, Tenn., Forked Deer River, Tenn., 183; water-gauges on the Mississippi River and its principal tributaries, 184.

In charge of Capt. H. S. Tabor, Corps of Engineers—

Red River above Fulton, Ark., 184; Little Red River, Ark., removing obstructions in Arkansas River, Ark., 185; Arkansas River, Ark. and Kans., 186; Petit Jean River, Ark., 187; Fourche River, Ark., White River, Ark., 188; Cache River, Ark., Black River, Ark. and Mo., 189; Black River, Mo., St. Francis River, Ark., St. Francis River, Mo. from Greenville to the Arkansas State line, 190; Little River, Mo. from Hornersville to its junction with the St. Francis River, 191.

In charge of Maj. A. M. Miller, Corps of Engineers—

Removing snags and wrecks from the Mississippi and Missouri Rivers, 191; removing obstructions Missouri River, Mississippi River between the Ohio and Illinois Rivers, 192; Gasconade River, Mo., 194; Osage River, Mo. and Kan., 195; examinations and survey, 195.

In charge of Capt. E. H. Ruffner, Corps of Engineers—

Mississippi River between the Des Moines Rapids and the mouth of the Illinois River, 196.

In charge of Maj. A. Mackenzie, Corps of Engineers—

Upper Mississippi River, operations of snag-boats and dredge-boats, 196; Mississippi River from Minneapolis to Des Moines Rapids, 197; Des Moines Rapids (Mississippi River), operating and care of Des Moines Rapids Canal, 198; Dry-dock at Des Moines Rapids Canal, harbors of refuge on Lake Pepin at Lake City, Minn., 199; harbors of refuge on Lake Pepin at Stockholm, Wis., 200.

In charge of Maj. Charles J. Allen, Corps of Engineers—

Preservation of the Falls of St. Anthony, Minn., 200; Construction of lock and dam on the Mississippi River at Meeker's Island, Minn., Mississippi River above the Falls of St. Anthony, Minn., 201; Reservoirs at headwaters of the Mississippi River, 202; Chippewa River, including Yellow Banks, Wis., St. Croix River, Wis. and Minn., 203; Minnesota River, Minn., Red River of the North, Minn. and Dak., 204; Missouri River from Sioux City, Iowa, to Fort Benton, Mont., 205; Yellowstone River, Mont. and Dak., 206; examinations and surveys, 206.

In charge of Lieut. Col. J. W. Barlow, Corps of Engineers—

Tennessee River, 207; French Broad River, Tenn., 208; Little Tennessee River, Tenn., Hiawassee River, Tenn., Clinch River, Tenn., 209; Duck River, Tenn., Cumberland River, Tenn. and Ky., 210; South Fork of Cumberland River, Ky., 211; Caney Fork River, Tenn., 212; examinations and survey, 212.

In charge of Lieut. Col. William E. Merrill, Corps of Engineers—

Ohio River, 213; operating and care of Davis Island Dam Ohio River, 314; Monongahela River, W. Va. and Pa., operating and care of lock and dam No. 9, Monongahela River, 215; Allegheney River, Pa., dam at Herr's Island Allegheney River, ice-harbor at mouth of Muskingum River, Ohio, 216; Muskingum River, Ohio, operating and care of the locks and dams on the Muskingum River, Ohio, 217; examinations and surveys, 218.

In charge of Maj. Amos Stickney, Corps of Engineers—

Falls of the Ohio, Louisville, Ky., 218; Indiana Chute Falls of the Ohio River, operating and care of the Louisville and Portland Canal, 219; Wabash River, Ind. and Ill., 220; White River, Ind., Tradewater River, Ky., 221.

In charge of Col. William P. Craighill, Corps of Engineers—

Great Kanawha River, W. Va., 222; operating and care of locks and dams on the Great Kanawha River, W. Va., harbor of refuge at mouth of Great Kanawha River, W. Va., 223; Elk River, W. Va., Ganley River, W. Va., 224; New River, Va. and W. Va., 225; examinations, 226.

In charge of Capt. D. W. Lockwood, Corps of Engineers—

Kentucky River, Ky., 226; operating and keeping in repair locks and dams on the Kentucky River, Ky., Licking River, Ky. from Farmer's to West Liberty, Big Sandy River, W. Va. and Ky., 227; Guyandotte River, W. Va., Little Kanawha River, W. Va., 228; Buckhannon River, W. Va., 229; examinations and surveys, 229.

In charge of Capt. James B. Quinn, Corps of Engineers—

Harbor at Duluth, Minn., 229; harbor at Superior Bay and St. Louis Bay, Wis., 230; harbor at Agate Bay, Minn., 231; harbor at Grand Marais, Minn., 232.

In charge of Maj. Charles E. L. B. Davis, Corps of Engineers—

Ashland Harbor, Wis., Ontonagon Harbor, Mich., Eagle Harbor, Mich., 233; establishment and maintenance of harbor-lines in Portage Lake, Mich., Marquette Harbor, Mich., 234; harbor of refuge Grand Marias, Mich., Manistique Harbor, Mich., 235; Cedar River Harbor, Mich., Menomonee Harbor, Mich. and Wis., 236; Oconto Harbor, Wis., Pensaukee Harbor, Wis., 237; Green Bay Harbor, Wis., harbor of refuge at entrance of Sturgeon Bay Canal, Wis., 238; Ahnapee Harbor, Wis., Kewaunee Harbor, Wis., 239; Two Rivers Harbor, Wis., Manitowoc Harbor, Wis., 240; Sheboygan Harbor, Wis., 241; Port Washington Harbor, Wis., 242.

In charge of Capt. W. L. Marshall, Corps of Engineers—

Harbor of refuge, Milwaukee Bay, Wis., 242; Milwaukee Harbor, Wis., 243; Racine Harbor, Wis., Kenosha Harbor, Wis., 244; Waukegan Harbor, Ill., Fox and Wisconsin Rivers, Wis., 245; operating and care of locks and dams on the Fox and Wisconsin Rivers, Wis., Chicago Harbor, Ill., 247; Calumet Harbor, Ill., 248; Illinois River, Ill., 249; Calumet River, Ill. and Ind., 250.

In charge of Maj. S. M. Mansfield, Corps of Engineers—

Charlevoix Harbor and entrance to Pine Lake, Mich., 251; Frankford Harbor, Mich., 252; harbor of refuge at Portage Lake, Mich., Manistee Harbor, Mich., Ludington Harbor, Mich., 253; Pentwater Harbor, Mich., White River Harbor, Mich., 254; Muskegon Harbor, Mich., Grand Haven Harbor, Mich., 255; Black Lake Harbor, Mich., Saugatuck Harbor, Mich., 256; South Haven Harbor, Mich., Saint Joseph Harbor, Mich., 257; Saint Joseph River, Mich. from its mouth to Berrien Springs, Michigan City Harbor, Ind., 258.

In charge of Lieut. Col. O. M. Poe, Corps of Engineers—

St. Mary's Falls Canal and River, Mich., 259; operating and care of St. Mary's Falls Canal, Mich., dry-dock at St. Mary's Falls Canal, Mich., 260; Hay Lake Channel, St. Mary's River, Mich., harbor at Sheboygan, Mich., 261; harbor at Thunder Bay, Mich., 262; harbor at Au Sable, Mich., Saginaw River, Mich., 263; harbor of refuge at Sand Beach Lake Huron, Mich., mouth of Black River, Mich., 264; Clinton River, Mich., St. Clair Flats Canal, Mich., 265; operating and care of St. Clair Flats Canal, Mich., 266; Grosse Point Channel, Mich., Detroit River, Mich., 267; Rouge River, Mich. at its junction with Detroit River and up the river as far as the bridge of St. Louis and Wabash Railroad, 268.

In charge of Maj. L. Cooper Overman, Corps of Engineers—

Monroe Harbor, Mich., 268; Toledo Harbor, Ohio, 269; Port Clinton Harbor, Ohio, 270; Sandusky City Harbor, Ohio, Sandusky River, Ohio, 271; Huron Harbor, Ohio, Vermillion Harbor, Ohio, 272; Black River Harbor, Ohio, Rocky River, Ohio, 273; Cleveland Harbor, Ohio, 274; Fairport Harbor, Ohio, 275; Ashtabula Harbor, Ohio, Conneaut Harbor, Ohio, 276.

In charge of Capt. F. A. Mahan, Corps of Engineers—

Erie Harbor, Penn., 277; preservation and protection of the Peninsula of Presque Isle (Erie Harbor) Penn., Dunkirk Harbor, N. Y., 278; Buffalo Harbor, N. Y., Tonawanda Harbor and Niagara River, N. Y., 279; Wilson Harbor, N. Y., Olcott Harbor, N. Y., 280; Oak Orchard Harbor, N. Y., 281; examination and survey, 282.

In charge of Capt. Carl F. Palfrey, Corps of Engineers—

Charlotte Harbor, N. Y., Great Sodus Harbor, N. Y., 282; Little Sodus Harbor, N.Y., 283; Oswego Harbor, N. Y., 284; Sackett's Harbor, N. Y., 285.

In charge of Maj. M. B. Adams, Corps of Engineers—

Ogdensburgh Harbor, N. Y., 285; Grass River (at Massena), N. Y., breakwater at Rouse's Point, Lake Champlain, N. Y., 286; Swanton Harbor, Vt., channel between the islands of North Hero and South Hero (Lake Champlain) Vt., breakwater at Gordon's Landing (Lake Champlain) Vt., 287; Plattsburgh Harbor, N. Y., Burlington Harbor, Vt., 288; Otter Creek, Vt., Ticonderoga River, N. Y., narrows at Lake Champlain, N. Y. and Vt., 289.

PACIFIC COAST.

In charge of Col. G. H. Mendell, Corps of Engineers—

Napa River, Cal., Oakland Harbor, Cal., 290; Redwood Harbor, Cal., survey of San Francisco Harbor, San Pablo and Suisun bays, Straits of Carquinez, and mouths of Sacramento and San Joaquin rivers, Cal., 291.

In charge of Maj. W. H. H. Benyaurd, Corps of Engineers—

Harbor at San Lius Obispo, Cal., Wilmington Harbor, Cal., 292; San Diego Harbor, Cal., surveys of San Diego Harbor, Newport Harbor, and San Lius Obispo Harbor, Cal., 293; examination and surveys, 293.

In charge of Maj. William H. Heuer, Corps of Engineers—

San Joaquin River, Stockton and Mormon Sloughs, Cal., 293; Mokelumne River, Cal., 294; Sacramento and Feather rivers, Cal., Petaluma Creek, Cal., 295; Humboldt Harbor and Bay, Cal., 296.

In charge of Capt. Willard Young, Corps of Engineers—

Coquille River, Oregon, 296; entrance to Coos Bay, Oregon, 297; Umpqua River, Oregon, 298; entrance to Yaquina Bay, Oregon, 299; Tillamook Bay and Bar, Oregon, 300; examination and survey, 300.

In charge of Maj. Thomas H. Handbury, Corps of Engineers—

Mouth of the Columbia River, Oregon and Wash., construction of canal at the Cascades (Columbia River) Oregon, 301; Chehalis River, Wash., 302; Skagit Steilaquamish Nootsack Snohomish and Snoqualmie rivers, Wash., gauging waters of the Columbia River, Oregon, 303; examinations and surveys, 304.

In charge of Major W. A. Jones, Corps of Engineers—

Columbia and Lower Willamette rivers below Portland, Oregon 304; Upper Willamette River, Oregon, Upper Columbia and Snake Rivers, Oregon and Wash., 305; Lower Clearwater River, Idaho, Cowlitz River, Wash., 306.

EXAMINATIONS, SURVEYS, AND CONTINGENCIES OF RIVERS AND HARBORS.

Estimate of funds required 306

MISSISSIPPI RIVER COMMISSION.................... 306

MISSOURI RIVER COMMISSION.................... 307

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES 307

Report of the Board of Engineers relative to the construction of certain brides across the Missouri, Mississippi, and Illinois rivers, 307; bridge across Staten Island Sound, known as Arthur Kill; report of Board of Engineers on Senate Bill No. 1850, Fiftieth Congress, first session, to authorize the construction of a bridge across the waters of Arthur Kill at or near the town of Westfield, Staten Island; highway bridge across that part of the waters of Lake Champlain lying between the towns of North Hero and Alburgh, Vt.; bridge of the Kansas City, Topeka and Western Railroad Company across Missouri River at Sibley, Mo.; bridge of the Chicago, Saint Louis and New Orleans Railroad Company across the Ohio River at East Cairo, Ky.; free wagon bridge across the Cumberland River near the city of Nashville, Tenn.; bridge of the Ohio River Railroad Company across Great Kanawha River near Point Pleasant, W. Va.; bridge across the west channel of the Detroit River, to connect Belle Isle Park with the mainland; international bridge of the Sault Sainte Marie Bridge Company across Sainte Marie River; bridge of the Nebraska Railway Company across Missouri River at Nebraska City, 308; combined railway and wagon bridge of the Omaha and Council Bluffs Railway and Bridge Company across Missouri River between Omaha, Nebr., and Council Bluffs, Iowa; bridge of the New York and Long Island Bridge Company across the East River between the city of New York and Long Island; bridge of the Ohio Valley Railway Company across the Tradewater River, Ky.; bridge of the Sioux City Bridge Company across the Missouri River at Sioux City, Iowa; highway bridge of the Central Railway and Bridge Company of Newport, Ky., across the Ohio River, between Cincinnati, Ohio, and Newport, Ky.; bridges of the Georgia Pacific Railroad Company across the Sunflower and Yazoo rivers; high bridge across the Mississippi River at Dubuque, Iowa; bridge of the Ohio Connecting Railway Company across the Ohio River, near the mouth of Cork's Run, in Allegheny County, Pa.; bridge of the Georgia Pacific Railway Company across the Tombigbee River at Waverly, Miss.; bridge of the Memphis and Charleston Railroad Company across the Tennessee River at Chattanooga, Tenn.; bridge of the Kansas City and Memphis Railway and Bridge Company across the Mississippi River at Memphis, Tenn., 309.

INTERFERENCES WITH NAVIGATION BY BRIDGES, CAUSEWAYS, AND OTHER STRUCTURES.......................... 309

OCCUPANCY OF AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS.............................. 310

MISCELLANEOUS.

IN CHARGE OF MAJ. G. J. LYDECKER, CORPS OF ENGINEERS—

Washington Aqueduct, increasing the water supply of the city of Washington, D. C., 310; erection of fish-ways at the Great Falls of the Potomac, 312.

IN CHARGE OF COL. JOHN M. WILSON, U. S. A.—

Improvement and care of public buildings and grounds in the District of Columbia, 312; underground telegraph and telephone lines, Washington Monument, 313.

CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES IN THE YELLOWSTONE NATIONAL PARK...................... 314

NORTHERN AND NORTHWESTERN LAKES.

Annual water levels; printing and distribution of charts........................ 316

MILITARY AND GEOGRAPHICAL MAPS................ 316

RECONNAISSANCES AND EXPLORATIONS.

Officers on duty in military divisions and departments, 316, 317; operations in Division of the Missouri, Department of the Columbia, Division of the Pacific, and Department of Platte, 317; estimate of funds required, 318.

OFFICE OF THE CHIEF OF ENGINEERS.

Officers in charge of divisions 319

STATEMENT SHOWING RANK AND DUTIES OF OFFICERS 320

APPENDIX No. 1.

REPORT OF MAJ. WILLIAM R. KING, CORPS OF ENGINEERS.

Post of Willets Point, N. Y., 345; Engineer School of Application, 347; Battalion of Engineers, 349; Recruiting, 350; Experiments, 351; Engineer Depot, Public Buildings and Constructions, Depot property, 355; Work of the depot, statement of funds, 356; Appendixes, 357.

RIVERS AND HARBORS, ETC.

APPENDIX A.

REPORT OF LIEUT. COL. JARED A. SMITH, CORPS OF ENGINEERS.

Improvements.—Lubec Channel, Me., 374; Moose-a-bec Bar, Me., 376; Narraguagus River, Me., 378; Bangor Harbor and Penobscot River, Me., 379; Belfast Harbor, Me., 381; Rockland Harbor, Me., 384; Portland Harbor, Me., 385; channel in Back Cove, Portland, Me., 387; breakwater at mouth of Saco River, Me., 389; Saco River, Me., 390; Kennebunk River, Me., 392; York Harbor, Me., 393; Portsmouth Harbor, N. H., 394; Cocheco River, N. H., 396; harbor of refuge at Little Harbor, N. H., 397.

Examinations and surveys.—Bayoduce [Bagaduce] River, Me., between the towns of Penobscot and Brooksville, 398; Camden Harbor, Me., 403; Rockport Harbor, Me., 407; Kennebec River, Me., at Bath, and from Augusta to lower end of Perkin's Island, 412; Penobscot River, Me., from Bangor to Bucksport Narrows, 425.

APPENDIX B.

REPORT OF LIEUT. COL. GEORGE L. GILLESPIE, CORPS OF ENGINEERS.

Improvements.—Newburyport Harbor, Mass., 433; Merrimac River, Mass., 436; Ipswich River, Mass., 438; harbor of refuge, Sandy Bay, Cape Ann, Mass., 439; Gloucester Harbor, Mass., 442; Lynn Harbor, Mass., 445; Boston Harbor, Mass., 447; Malden River, Mass., 456; Hingham Harbor, Mass., 456; Scituate Harbor, Mass., 458; Plymouth Harbor, Mass., 459; Provincetown Harbor, Mass., 462.

Examinations and surveys.—Manchester Harbor, Mass., 463; Winthrop Harbor, Mass., 468; Duxbury Harbor, Mass., 472; Wellfleet Harbor, Mass., 476.

APPENDIX C.

REPORT OF MAJ. WILLIAM R. LIVERMORE, CORPS OF ENGINEERS.

Improvements.—Harbor of refuge at Hyannis, Mass., 484; harbor of refuge at Nantucket, Mass., 486; Wood's Holl Harbor, Mass., 488; Wareham Harbor, Mass., 489; Westport Harbor, Mass., 491; Taunton River, Mass., 492; Warren River, R. I., 494; Pawtucket River, R. I., 496; Providence River and Narragansett Bay, R. I., 498; removal of Green Jacket Shoal, Providence River, R. I., 500; Newport Harbor, R. I., 502; harbor of refuge at Block Island, R. I., 504; Little Narragansett Bay, R. I. and Conn., 508; Pawcatuck River, R. I. and Conn., 509; harbor of refuge at Stonington, Conn., 511.

Examinations and surveys.—New Bedford Harbor, Mass., 513; Taunton River, Mass., 515.

APPENDIX D.

REPORT OF LIEUT. COL. D. C. HOUSTON, CORPS OF ENGINEERS.

IMPROVEMENTS.—Thames River, Conn., 521; New London Harbor, Conn., 525; Connecticut River, Mass. and Conn., 527; Clinton Harbor, Conn., 538; New Haven Harbor, Conn., 540; breakwater at New Haven, Conn., 544; Milford Harbor, Conn., 548; Housatonic River, Conn., 551; Bridgeport Harbor, Conn., 555; Black Rock Harbor, Conn., 558; Southport Harbor, Conn., 561; Norwalk Harbor, Conn., 562; Stamford Harbor, Conn., 564; Port Chester Harbor, N. Y., 567; Mamaroneck Harbor, N. Y., 569; Echo Harbor, New Rochelle, N. Y., 570; New Rochelle Harbor, N. Y., 572; East Chester Creek, N. Y., 574; Greenport Harbor, N. Y., 577; Port Jefferson Harbor, N. Y., 578; Flushing Bay, N. Y., 581; removing sunken vessels or craft obstructing or endangering navigation, 583.

APPENDIX E.

REPORT OF LIEUT. COL. WALTER McFARLAND, CORPS OF ENGINEER.

IMPROVEMENTS.—Hudson River, N. Y., 588; Harbor of Saugerties, N. Y., 594; Harbor at Rondout, N. Y., 596; Harlem River, N. Y., 598; removing obstructions in the East River and at Hell Gate, N. Y., 603; Newtown Creek, N. Y., 606; Buttermilk Channel, N. Y., 610; Gowanus Bay, N. Y., 613; New York Harbor, 617; Sheepshead Bay, N. Y., 624; Harbor at Canarsie Bay, N. Y., 627; Sumpawanus Inlet, N. Y., 629; channel between Staten Island and New Jersey, 631; Raritan Bay, N. J., 633; removing sunken vessels or craft obstructing or endangering navigation, 637.

EXAMINATIONS AND SURVEY.—Spring Creek, N. Y., 638; Hudson River, N.Y., between New Baltimore and Coxsackie, 640.

APPENDIX F.

REPORT OF CAPT. GEORGE McC. DERBY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Passaic River, N. J., 645; Elizabeth River, N. J., 648; Rahway River, N. J., 649; Woodbridge Creek, N. J., 650; Raritan River, N. J., 652; South River, N. J., 657; Cheesequakes Creek, N. J., 661; Keyport Harbor, N. J., 662; Mattawan Creek, N. J., 663; Shrewsbury River, N. J., 665; Manasquan River, N. J., 667.

APPENDIX G.

REPORT OF LIEUT. COL. HENRY M. ROBERT, CORPS OF ENGINEERS.

IMPROVEMENT.—Delaware River, Pa. and N. J., 669; Frankford Creek, Pa., 698; Schuylkill River, Pa., 699; ice-harbor at Marcus Hook, Pa., 701; ice-harbor at the head of Delaware Bay, Del., 704; construction of iron pier in Delaware Bay, near Lewes, Del., 705; harbor at Delaware Breakwater, Del., 707; Rancocas River, N. J., 708; Woodbury Creek, N, J., 710; Mantua Creek, N. J., 711; Raccoon River, N. J., 712; Salem River, N. J., 712; Cohansey Creek, N. J., 714; removal of wreck from Delaware Bay and River, 716; removing sunken vessels or craft obstructing or endangering navigation, 716; survey of harbor at Atlantic City, N. J., 717; United States Commission advisory to the Board of Harbor Commissioners of Philadelphia, Pa., 718.

EXAMINATIONS AND SURVEY.—Thoroughfare from Cape May to the Great Bay north of Atlantic City, N. J., 724.

APPENDIX H.

REPORT OF MR. WILLIAM F. SMITH, UNITED STATES AGENT.

IMPROVEMENTS.—Maurice River, N. J., 738; Wilmington Harbor, Del., 739; ice-harbor at New Castle, Del., 740; Duck Creek, Del., 741; Saint Jones River, Del., 742; Mispillion Creek, Del., 743; Broadkiln River, Del., 744; Indian River, Del., 744; inland water-way from Chincoteague Bay, Va., to Delaware Bay, at or near Lewes, Del., 745; Susquehanna River above and below Havre de Grace, Md., 746; Chester River at Kent Island Narrows, Md., 747; Corsica Creek, Md., 747; Choptank River, Md., 748; Nanticoke River, Del., 749; Broad Creek, Del., from its mouth to Laurel, 750; Wicomico River, Md., 751; Upper Thoroughfare between Deil's Island and the mainland, 751; Pocomoke River, Md., 752; removing sunken vessels or craft obstructing or endangering navigation, 753.

PART II.

APPENDIX I.

REPORT OF COL. WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Patapsco River and channel to Baltimore, Md., 756; Annapol Harbor, Md., 761; James River, Va., 761; harbor of Norfolk, and its approache Va., 766; approach to Norfolk Harbor and the United States (Norfolk) navy-yar between Lambert's Point and Fort Norfolk, Va., 767; Archer's Hope River, Va 768; Appomattox River, Va., 768; North Landing River, Va. and N. C., 770; Currituck Sound, Coanjok Bay, and North River Bar, N. C., 770; Blackwater River, Va., 772; Nottaway River, Va., 773; Meherrin River, N. C., 773; Edenton Bay, N. C., 773; removing sunken vessels or craft obstructing or endangering navigation 774.

APPENDIX J.

REPORT OF LIEUT. COL. PETER C. HAINS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Potomac River at Washington, D. C., 777; reconstruction of the Aqueduct Bridge, Georgetown, D. C., 789; bridge across the Eastern Branch of the Potomac River, D. C., 795; Shenandoah River, W. Va., 804; wharf at Fort Monroe, Va., 804.

SURVEY.—James Creek Canal, emptying into Anacostia River, D. C., 807.

APPENDIX K.

REPORT OF MR. S. T. ABERT, UNITED STATES AGENT.

IMPROVEMENTS.—Channel at Mount Vernon, Va., 813; Neabsco Creek, Va., 814; Breton Bay, Leonardtown, Md., 815; Nomini Creek, Va., 816; harbor at entrance of St. Jerome's Creek, Md., 818; Rappahannock River, Va., 819; Totusky River, Va., 824; Urbana Creek, Va., 825; Mattaponi River, Va., 826; Pamunky River, Va., 828; York River, Va., 830; Chicahominy River, Va., 832; Staunton River, Va., 834; Dan River, between Madison, N. C., and Danville, Va., 838; Roanoke River, N. C., 840; French Broad River, N. C., 843; removing sunken vessels or craft obstructing or endangering navigation, 845.

EXAMINATION AND SURVEY.—Patuxent River, Md., from Benedict to Hill's Landing, 846.

APPENDIX L.

REPORT OF CAPT. WILLIAM H. BIXBY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Pamlico and Tar rivers, N. C., 854; Contentnia Creek, N. C., 858; Trent River, N. C., 862; Neuse River N. C., 866; Inland water-way between New Berne and Beaufort, N. C., 871; Harbor at Beaufort, N. C., 875; Inland water-way between Beaufort Harbor and New River, N. C., through Bogue Sound, 882; New River N. C., 885; Black River, N. C., 889; Cape Fear River, N. C., 893; Waccemaw River, S. C., 912; Yadkin River, N. C., 917; Great Pee Dee River, S. C., 920; Harbor at Georgetown, S. C., 925; Winyaw Bay, S. C., 929; Santee River, S. C., 933; Wateree River, S. C., 939; Congaree River, S. C., 943.

EXAMINATIONS AND SURVEYS.—Yadkin River, N. C., from the South Carolina line to the Narrows, N. C., 948; Catawba River, N. C., 958.

APPENDIX M.

REPORT OF FIRST. LIEUT. FREDERIC V. ABBOT, CORPS OF ENGINEERS.

IMPROVEMENTS.—Charleston Harbor, S. C., 970; Wappoo Cut, S. C., 980; Ashley River, S. C., 983; Edisto River, S. C., 985; Salkiehatchie River, S. C., 987; removing sunken vessels or craft obstructing or endangering navigation, 990.

EXAMINATIONS AND SURVEYS.—North fork of the Edisto River, S. C., in the counties of Orangeburgh and Lexington, 991; Mosquito Creek, between the South Edisto and Ashepoo rivers, with a view to connect the South Edisto with the Ashepoo at or near Fenwick's Island, S. C., 997.

APPENDIX N.

REPORT OF FIRST LIEUT. O. M. CARTER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Savannah Harbor and River, Ga., 1005; Savannah River, between Savannah and Augusta, Ga., 1026; Savannah River, above Augusta, Ga., 1030; Romley Marsh, Ga., 1033; Altamaha River, Ga., 1035; Doboy Bar, Ga., 1041; Brunswick Harbor, Ga., 1044; Cumberland Sound, Ga. and Fla., 1050.

EXAMINATIONS AND SURVEYS.—Savannah River from Cross Tides above Savannah to the bar, with a view to obtaining 28 feet of water in the channel, 1056; Jekyl Creek, Ga., 1073.

APPENDIX O.

REPORT OF CAPT. WILLIAM M. BLACK, CORPS OF ENGINEERS.

IMPROVEMENTS.—St. John's River, Fla., 1079; Volusia Bar, Fla., 1088; Upper St. John's River, Fla., 1090; Northwest entrance Key West Harbor, Fla., 1092; Caloosahatchie River, Fla., 1093; Pease River, Fla., 1102; Manatee River, Fla., 1107; Tampa Bay, Fla., 1112; Withlacoochee River, Fla., 1114; harbor at Cedar Keys, Fla., 1116; Suwanee River, Fla., 1118; removing sunken vessels or craft obstructing or endangering navigation, 1122.

EXAMINATIONS AND SURVEYS.—Saint Augustine, Fla., for a deep-sea channel on the outer bar, 1123; Punta Rassa Harbor, Fla., 1154.

APPENDIX P.

REPORT OF CAPT. R. L. HOXIE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Apalachicola River, Fla., 1159; Apalachicola Bay, Fla., 1160; La Grange Bayou, Fla., 1162; Pensacola Harbor, Fla., 1163; Choctawhatchee River, Fla. and Ala., 1166; Escambia and Conecuh rivers, Fla. and Ala., 1169; Oconee River, Ga., 1170; Ocmulgee River, Ga., 1173; Oostenaula and Coosawattee rivers, Ga., 1175; Flint River, Ga., 1175; Coosa River, Ga. and Ala., 1178; Chattahoochee River, Ga. and Ala., 1181; Tallapoosa River, Ala., 1184; Cahawba River, Ala., 1185; Alabama River, Ala., 1187; removing sunken vessels or craft obstructing or endangering navigation, 1189; resurvey of outer and inner bars at Pensacola, Fla., 1191.

APPENDIX Q.

REPORT OF MAJ. A. N. DAMRELL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mobile Harbor, Ala., 1193; Black Warrior River, from Tuscaloosa to Daniel's Creek, Ala., 1198; Warrior River, Ala., 1200; Tombigbee River, from Fulton to Vienna, 1204; Tombigbee River, below Vienna, 1206; Noxubee River, Miss., 1208; Pascagoula River, Miss., 1210; Harbor at Biloxi Bay, Miss., 1214; Pearl River, Miss., between Edinburgh and Carthage, 1216; Pearl River, Miss., from Jackson to Carthage, 1218; Pearl River, Miss., below Jackson, 1221.

EXAMINATION AND SURVEY.—Tombigbee River, to ascertain what improvement is necessary to make said river continuously navigable from Vienna, Ala., to Walker's Bridge, Miss., 1226; survey of the Warrior River below Tuscaloosa; the Tombigbee River from its mouth up to Vienna, and from Vienna up to Walker Bridge, 1227.

APPENDIX R.

REPORT OF CAPT. W. L. FISK, CORPS OF ENGINEERS.

INSPECTION.—Improvement at the South Pass of the Mississippi River, 1229.

APPENDIX S.

REPORT OF CAPT. W. L. FISK, CORPS OF ENGINEERS.

IMPROVEMENTS.—Tchefuncte River and Bogue Falia, La., 1243; Tangipahoa River, La., 1245; Tickfaw River, La., 1246; Amite River, La., 1247; Bayou La Fourche, La., 1248; Bayou Terrebonne, La., 1250; Bayou Black, La., 1251; Bayou Teche, La., 1253; connecting Bayou Teche with Grand Lake at Charenton, La., 1253; Bayou Courtableau, La., 1254; Calcasieu River and Pass, La., 1256; Bayou Pierre, Miss., 1258; Sabine River, La. and Tex., 1259; Neches River, Tex., 1260; Sabine Pass, Tex., 1261.

APPENDIX T.

REPORT OF MAJ. O. H. ERNST, CORPS OF ENGINEERS.

IMPROVEMENTS.—Entrance to Galveston Harbor, Tex., 1265; ship-channel in Gal ton Bay, Tex., 1279; Trinity River, Tex., 1285; Buffalo Bayou, Tex., 1286; mout Brazos River, Tex., 1291; Pass Cavallo Inlet to Matagorda Bay, Tex., 1301; Ara Pass and Bay, up to Rockport and Corpus Christi, Tex., 1307; harbor at Br Santiago, Tex., 1320.

APPENDIX U.

REPORT OF CAPT. JOSEPH H. WILLARD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Red River, La. and Ark., 1331; Cypress Bayou, Tex. and La., 13 Ouachita and Black Rivers, Ark. and La., 1346; Bayou D'Arbonne, La., 13 Bayou Bartholomew, La. and Ark., 1351; Bayou Bœuf, La., 1353; Tensas River Bayou Macon, La., 1354; Big Black River, Miss., 1356; Yazoo River, Miss., 13 Tchula Lake, Miss., 1361; Yallabusha River, Miss., 1362; Tallahatchee River, Mi 1363; Steele's Bayou, Miss., 1364; Big Sunflower River, Miss., 1365; Big Hatc River, Tenn., 1367; Forked Deer River, Tenn., 1369; water-gauges on the Mis sippi River and its principal tributaries, 1370.

APPENDIX V.

REPORT OF CAPT. H. S. TABER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Red River above Fulton, Ark., 1375; Little Red River, Ark., 1377 removing obstructions in Arkansas River, Ark., 1378; Arkansas River, Ark., 138 Petit Jean River, Ark., 1400; Fourche River, Ark., 1402; White River, Ark., 1403 Black River, Ark. and Mo., 1413; St. Francis River, Ark., 1414.

PART III.

APPENDIX W.

REPORT OF MAJ. A. M. MILLER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Removing snags and wrecks from the Mississippi and Missouri rivers 1419; Mississippi River between the Ohio and Illinois rivers, 1422; Gasconade River Mo., 1448; Osage River, Mo. and Kan., 1450.

EXAMINATIONS AND SURVEY.—Mississippi River, at Rush Island Bend and Ivy Landing, Ill., 1452; Kaskaskia River, from New Athens to its mouth, 1453.

APPENDIX X.

REPORT OF CAPT. E. H. RUFFNER, CORPS OF ENGINEERS.

IMPROVEMENT.—Mississippi River between the Des Moines Rapids and the mouth o the Illinois River, 1461.

APPENDIX Y.

REPORT OF MAJ. ALEXANDER MACKENZIE, CORPS OF ENGINEERS.

IMPROVEMENTS.—Upper Mississippi River, operations of snag-boats and dredge-boats 1471; Mississippi River from Des Moines Rapids to mouth of the Illinois River 1479; Mississippi River from Saint Paul to Des Moines Rapids, 1480; Des Moine Rapids, Mississippi River, 1518; operating and care of Des Moines Rapids Canal 1521; Dry-dock at Des Moines Rapids Canal, 1527; ice-harbor at Dubuque, Iowa. 1529; harbors of refuge on Lake Pepin, at Lake City, Minn., 1529; harbors o refuge on Lake Pepin, at Stockholm, Wis., 1532.

APPENDIX Z.

REPORT OF MAJ. CHARLES J. ALLEN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Preservation of the Falls of St. Anthony, Minn., 1536; Construction of lock and dam on the Mississippi River at Meeker's Island, Minn., 1536; Mississippi River above the Falls of St. Anthony, Minn., 1537; reservoirs at headwaters of the Mississippi River, 1539; Chippewa River, including Yellow Banks, Wis., 1542; St. Croix River, Wis. and Minn., 1547; Minnesota River, Minn., 1551; Red River of the North, Minn. and Dak., 1552; construction of lock and dam at Goose Rapids, Red River of the North, Minn. and Dak., 1555; survey for reservoirs at the sources of the Mississippi, St. Croix, Chippewa, and Wisconsin rivers, 1555; Missouri River from Sioux City, Iowa, to Fort Benton, Mont., 1556; Yellowstone River, Mont. and Dak., 1559.

EXAMINATIONS AND SURVEYS.—Mississippi River between Saint Paul and St. Anthony's Falls, Minn., 1560; Minnesota River, with a view to its improvement by locks and dams, 1571; Red River of the North, Minn., from Moorhead to Fergus Falls, 1584.

APPENDIX A A.

REPORT OF LIEUT. COL. J. W. BARLOW, CORPS OF ENGINEERS.

IMPROVEMENTS.—Tennessee River, 1591; French Broad River, Tenn., 1602; Little Tennessee River, Tenn., 1604; Hiawassee River, Tenn., 1605; Clinch River, Tenn., 1606; Duck River, Tenn., 1610; Cumberland River, Tenn. and Ky., 1611; South Fork of Cumberland River, Ky., 1633; Caney Fork River, Tenn., 1634.

EXAMINATION AND SURVEY.—Obeil's [Obey's] River from the point where improvements have heretofore been made to the mouth of the West Fork, Tenn., 1636; Bear Creek, Miss. and Ala. [Big Bear Creek, Miss. and Ala.], 1639.

APPENDIX B B.

REPORT OF LIEUT. COL. WILLIAM E. MERRILL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Ohio River, 1644; operating and care of Davis Island Dam, Ohio River, 1670; Monongahela River, W. Va. and Pa., 1676; operating and care of lock and dam No. 9, Monongahela River, 1678; Allegheny River, Pa., 1680; lock and dam at Herr's Island, Allegheny River, 1682; ice-harbor at mouth of Muskingum River, Ohio, 1683; operating and care of the locks and dams on the Muskingum River, Ohio, 1684.

EXAMINATIONS AND SURVEYS.—Ohio River, near the city of Evansville, Ind., to determine what, if anything, will be necessary to prevent a change of the channel of the river in front of that city, 1715; Big Hockhocking River, Ohio, from its mouth to Coolville, 1719.

APPENDIX C C.

REPORT OF MAJ. AMOS STICKNEY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Falls of the Ohio and enlargement of Louisville and Portland Canal, Louisville, Ky., 1723; Indiana Chute, Falls of the Ohio River, 1727; operating and care of the Louisville and Portland Canal, 1728; Wabash River, Ind. and Ill., 1738; White River, Ind., 1745; Tradewater River, Ky., 1747.

APPENDIX D D.

REPORT OF COL. WILLIAM P. CRAIGHILL, CORP OF ENGINEERS.

IMPROVEMENTS.—Great Kanawha River, W. Va., 1749; operating and care of locks and dams on the Great Kanawha River, W. Va., 1756; harbor of refuge at mouth of Great Kanawha River, W. Va., 1759; Elk River, W. Va., 1760; New River, Va. and W. Va., 1760.

EXAMINATIONS.—Gauley River and Meadow River, W. Va., 1761.

APPENDIX E E.

REPORT OF CAPT. D. W. LOCKWOOD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Kentucky River, Ky., 1770; operating and keeping in repair lock and dams on the Kentucky River, Ky., 1775; Big Sandy River, W. Va. and Ky., 1786; Guyandotte River, W. Va., 1791; Little Kanawha River, W. Va., 1792; Buckhannon River, W. Va., 1794.

EXAMINATIONS AND SURVEYS.—Louisa [Levisa] Fork of Sandy River, Va., 1795; Salt River, Ky., 1798.

APPENDIX F F.

REPORT OF CAPT. JAMES B. QUINN, CORPS OF ENGINEERS.

IMPROVEMENTS.—Harbor at Duluth, Minn., 1803; harbor at Superior Bay and St. Louis Bay, Wis., 1809; harbor at Agate Bay, Minn., 1812; harbor at Grand Marais, Minn., 1814.

APPENDIX G G.

REPORT OF MAJ. CHARLES E. L. B. DAVIS, CORPS OF ENGINEERS.

IMPROVEMENTS.—Ashland Harbor, Wis., 1817; Ontanagon Harbor, Mich., 1819; Eagle Harbor, Mich., 1821; establishment and maintenance of harbor-lines in Portage Lake, Mich., 1822; Marquette Harbor, Mich., 1831; harbor of refuge, Grand Marais, Mich., 1832; Manistique Harbor, Mich., 1835; Cedar River Harbor, Mich., 1835; Menomonee Harbor, Mich. and Wis., 1837; Oconto Harbor, Wis., 1839; Pensaukee Harbor, Wis., 1841; Green Bay Harbor, Wis., 1842; harbor of refuge at entrance of Sturgeon Bay Canal, Wis., 1844; Ahnapee Harbor, Wis., 1846; Kewaunee Harbor, Wis., 1848; Two Rivers Harbor, Wis., 1850; Manitowoc Harbor, Wis., 1851; Sheboygan Harbor, Wis., 1853; Port Washington Harbor, Wis., 1856.

APPENDIX H H.

REPORT OF CAPT. W. L. MARSHALL, CORPS OF ENGINEERS.

IMPROVEMENTS.—Harbor of refuge, Milwaukee Bay, Wis., 1859; Milwaukee Harbor, Wis., 1862; Racine Harbor, Wis., 1865; Kenosha Harbor, Wis., 1866; Waukegan Harbor, Ill., 1867; Fox and Wisconsin rivers, Wis., 1869; operating and care of locks and dams on the Fox and Wisconsin rivers, Wis., 1878; Chicago Harbor, Ill., 1886; Calumet Harbor, Ill., 1888; Illinois River, Ill., 1889; Calumet River, Ill. and Ind., 1896; surveys for Hennepin Canal, 1898.

APPENDIX I I.

REPORT OF MAJ. S. M. MANSFIELD, CORPS OF ENGINEERS.

IMPROVEMENTS.—Charlevoix Harbor and entrance to Pine Lake, Mich., 1899; Frankford Harbor, Mich., 1901; harbor of refuge at Portage Lake, Mich., 1903; Manistee Harbor, Mich., 1904; Ludington Harbor, Mich., 1905; Pentwater Harbor, Mich., 1907; White River Harbor, Mich., 1908; Muskegon Harbor, Mich., 1910; Grand Haven Harbor, Mich., 1911; Black Lake Harbor, Mich., 1913; Saugatuck Harbor, Mich., 1914; South Haven Harbor, Mich., 1916; Saint Joseph Harbor, Mich., 1917 Michigan City Harbor, Ind., 1919.

APPENDIX J J.

REPORT OF LIEUT. COL. O. M. POE, CORPS OF ENGINEERS.

IMPRONEMENTS.—St. Mary's Falls Canal and River, Mich., 1924; operating and care of St. Mary's Falls Canal, Mich., 1987; Dry-dock at St. Mary's Falls Canal, Mich., 1953; Hay Lake Channel, St. Mary's River, Mich., 1954; harbor at Sheboygan, Mich., 1958; harbor at Thunder Bay, Mich., 1961; harbor at Au Sable, Mich., 1962; Saginaw River, Mich., 1963; harbor of refuge at Sand Beach, Lake Huron, Mich., 1968; steam-launch or tug for harbor of refuge at Sand Beach, Lake Huron, Mich., 1972; ice-harbor of refuge at Belle River, Mich., 1972; Clinton River, Mich., 1973; St. Clair Flats Canal, Mich., 1975; operating and care of St. Clair Flats Canal, Mich., 1976; Grosse Point Channel, Mich., 1978; Detroit River, Mich., 1978.

APPENDIX K K.

REPORT OF MAJ. L. COOPER OVERMAN, CORPS OF ENGINEERS.

Improvements.—Monroe Harbor, Mich., 1981; Toledo Harbor, Ohio, 1983; Port Clinton Harbor, Ohio, 1986; Sandusky City Harbor, Ohio, 1988; Sandusky River, Ohio, 1996; Huron Harbor, Ohio, 1997; Vermillion Harbor, Ohio, 1998; Black River Harbor, Ohio, 1999; Rocky River, Ohio, 2001; Cleveland Harbor, Ohio, 2001; Fairport Harbor, Ohio, 2011; Ashtabula Harbor, Ohio, 2013; Conneaut Harbor, Ohio, 2015.

APPENDIX L L.

REPORT OF CAPT. FREDERICK A. MAHAN, CORPS OF ENGINEERS.

Improvements.—Erie Harbor, Pa., 2017; Dunkirk Harbor, N. Y., 2024; Buffalo Harbor, N. Y., 2028; Niagara River, N. Y., 2056; Wilson Harbor, N. Y., 2057; Olcott Harbor, N. Y., 2059; Oak Orchard Harbor, N. Y., 2062.
Examination and Survey.—Tonawanda Harbor and Niagara River, N. Y., between Black Rock and Tonawanda, with a view to a 16-foot channel, 2064.

APPENDIX M M.

REPORT OF CAPT. CARL F. PALFREY, CORPS OF ENGINEERS.

Improvements.—Charlotte Harbor, N. Y., 2069; Pultneyville, N. Y., 2073; Great Sodus Harbor, N. Y., 2075; Little Sodus Harbor, N. Y., 2079; Oswego Harbor, N. Y., 2082; Sackett's Harbor, N. Y., 2086.

APPENDIX N N.

REPORT OF MAJ. MILTON B. ADAMS, CORPS OF ENGINEERS.

Improvements.—Ogdensburgh Harbor, N. Y., 2089; Grass River (at Massena), N. Y., 2092; breakwater at Rouse's Point, Lake Champlain, N. Y., 2093; Swanton Harbor, Vt., 2094; breakwater at Gordon's Landing, Lake Champlain, Vt., 2095; Plattsburgh Harbor, N. Y., 2097; Burlington Harbor, Vt., 2098; Otter Creek, Vt., 2100; Ticonderoga River, N. Y., 2101; Narrows at Lake Champlain, N. Y. and Vt., 2102.

APPENDIX O O.

REPORT OF COL. G. H. MENDELL, CORPS OF ENGINEERS.

Improvements.—Oakland Harbor, Cal., 2105; Redwood Harbor, Cal., 2108; survey of San Francisco Harbor, San Pablo and Suisun bays, Straits of Carquinez, and mouths of Sacramento and San Joaquin rivers, Cal., 2108.

APPENDIX P P.

REPORT OF MAJ. W. H. H. BENYAURD, CORPS OF ENGINEERS.

Improvements.—Wilmington Harbor, Cal., 2111; San Diego Harbor, Cal., 2114.
Examination and Surveys.—Entrance and outer bar at San Diego, Cal., 2114; Newport Harbor, Cal., 2118; San Pedro Bay, Cal., 2122.

APPENDIX Q Q.

REPORT OF MAJ. WILLIAM H. HEUER, CORPS OF ENGINEERS.

Improvements.—San Joaquin River, Stockton and Mormon sloughs, Cal., 2129; Mokelumne River, Cal., 2131; Sacramento and Feather rivers, Cal., 2132; Petaluma Creek, Cal., 2133; Humboldt Harbor and Bay, Cal., 2135.

APPENDIX R R.

REPORT OF CAPT. WILLARD YOUNG, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mouth of Coquille River, Oregon, 2137; entrance to Coos Bay, Oregon, 2141; Umpqua River, Oregon, 2144; entrance to Yaquina Bay, Oregon, 2146.
EXAMINATION AND SURVEY.—Tillamook Bay and Bar, Oregon, 2150.

APPENDIX S S.

REPORT OF MAJ. THOMAS H. HANDBURY, CORPS OF ENGINEERS.

IMPROVEMENTS.—Mouth of the Columbia River, Oregon and Wash., 2155; construction of canal at the Cascades, Columbia River, Oregon, 2161; Chehalis River, Wash., 2174; Skagit, Steilaquamish, Nootsack, Snohomish, and Snoqualmie rivers, Wash., 2176; gauging waters of the Columbia River, Oregon, 2177.
EXAMINATIONS.—Wood River, Oregon, 2177; Link River, Oregon, 2179.

APPENDIX T T.

REPORT OF MAJ. WILLIAM A. JONES, CORPS OF ENGINEERS.

IMPROVEMENTS.—Columbia and Lower Willamette Rivers, below Portland, Oregon, 2185; Upper Willamette River, Oregon, 2187; Upper Columbia and Snake Rivers, Oregon and Wash., 2188; Lower Clearwater River, Idaho, 2189; Cowlitz River, Wash., 2190.

PART IV.

APPENDIX U U.

REPORTS OF THE MISSISSIPPI RIVER COMMISSION.

Q. A. GILLMORE, Colonel of Engineers, Bvt. Maj. Gen. U. S. A. (*president* until his death, April 7, 1888),
C. B. COMSTOCK, Lieut. Col. of Engineers, Bvt. Brig. Gen. U. S. A. (*president* from April 10, 1888),
CHARLES R. SUTER, Lieut. Col. of Engineers, U. S. A.,
O. H. ERNST, Major of Engineers, U. S. A. (from May 15, 1888),
Mr. HENRY MITCHELL, U. S. Coast and Geodetic Survey,
Mr. B. M. HARROD, Civil Engineer,
Mr. S. W. FERGUSON, Civil Engineer,
Mr. ROBERT S. TAYLOR,
Commissioners.

REPORT OF OPERATIONS FROM JULY 1 TO NOVEMBER 1, 1887—

Surveys, construction, 2191; first district, second district, 2192; third district, 2193; fourth district, money statement, 2194; operations in the first district, 2195; operations in the second district, 2203.

ANNUAL REPORT FOR THE FISCAL YEAR—

Survey and examinations, 2214; *Construction*—General service, first district, 2214; second district, third district, 2215; fourth district, 2217; remarks, 2218; list of appendices, list of plates, 2219; effect of overflow on velocity and flood height, 2220; elevations and descriptions of secondary triangulation stations, Cairo to Donaldsonville, 2232; geographical positions of tertiary points, Keokuk to Cairo, 2244; High-water marks of 1888, 2250; low-water gauge-readings, 1887-'88, 2251; table of low-water soundings on bars, 1886-'87, 2251; report of committee on construction, 2252; operations in the first district, 2262; operations in the second district, 2270; operations in the third district, 2276; operations in the fourth district, 2294.

APPENDIX V V.

REPORT OF THE MISSOURI RIVER COMMISSION.

CHARLES R. SUTER, Lieut. Col. of Engineers, U. S. A., *president*,
ALEX. MACKENZIE, Major of Engineers, U. S. A.,
O. H. ERNST, Major of Engineers, U. S. A.,
Mr. G. C. BROADHEAD,
Mr. WM. J. BROATCH,
Commissioners.

Surveys, construction, 2313; plant, surveys at special localities, recommendations, 2314; money statement, 2315; report of the secretary, 2317; report of the secretary on precise leveling, 2327; description of elevations and bench-marks, 2328; physical data, 2355; report of the president, 2356; reports of operations by assistant engineers, 2357, 2359.

APPENDIX W W.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

Report of the Board of Engineers relative to the construction of certain bridges across the Missouri, Mississippi, and Illinois rivers, 2371; bridge across Staten Island Sound, known as Arthur Kill, 2421; report of Board of Engineers on Senate bill No. 1850, Fiftieth Congress, first session, to authorize the construction of a bridge across the waters of Arthur Kill at or near the town of Westfield, Staten Island, 2430; highway bridge across that part of the waters of Lake Champlain lying between the towns of North Hero and Alburgh, Vt., 2431; bridge of the Kansas City, Topeka and Western Railroad Company across Missouri River at Sibley, Mo., 2434; bridge of the Chicago, Saint Louis and New Orleans Railroad Company across the Ohio River at East Cairo, Ky., 2436; free wagon bridge across the Cumberland River near the city of Nashville, Tenn., 2438; bridge of the Ohio River Railroad Company across Great Kanawha River, near Point Pleasant, W. Va., 2444; bridge across the west channel of the Detroit River, to connect Belle Island Park with the mainland, 2450; international bridge of the Sault Sainte Marie Bridge Company across Sainte Marie River, 2456; bridge of the Nebraska Railway Company across Missouri River at Nebraska City, 2464; combined railway and wagon bridge of the Omaha and Council Bluffs Railway and Bridge Company across Missouri River between Omaha, Nebr., and Council Bluffs, Iowa, 2467; bridge of the New York and Long Island Bridge Company across the East River between the city of New York and Long Island, 2470; bridge of the Ohio Valley Railway Company across the Tradewater River, Ky., 2472; bridge of the Sioux City Bridge Company across the Missouri River at Sioux City, Iowa, 2474; highway bridge of the Central Railway and Bridge Company of Newport, Ky., across the Ohio River, between Cincinnati, Ohio, and Newport, Ky., 2480; bridges of the Georgia Pacific Railroad Company across the Sunflower and Yazoo rivers, 2485; high bridge across the Mississippi River at Dubuque, Iowa, 2492; bridge of the Ohio Connecting Railway Company across the Ohio River, near the mouth of Cork's Run, in Allegheny County, Pa., 2497; bridge of the Georgia Pacific Railway Company across the Tombigbee River at Waverly, Miss., 2507; bridge of the Memphis and Charleston Railroad Company across the Tennessee River at Chattanooga, Tenn., 2510; bridge of the Kansas City and Memphis Railway and Bridge Company across the Mississippi River at Memphis, Tenn., 2514; reports respecting interferences with navigation by bridges, causeways, and other structures, 2525.

APPENDIX X X.

OCCUPANCY AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS, 2687.

APPENDIX Y Y.

REPORT OF MAJ. G. J. LYDECKER, CORPS OF ENGINEERS.

IMPROVEMENTS.—Washington Aqueduct, 2749; increasing the water supply of the city of Washington, D. C., 2755; erection of fish-ways at the Great Falls of the Potomac, 2766.

APPENDIX Z Z.

REPORT OF COL. JOHN M. WILSON, U. S. ARMY.

Improvement and care of public buildings and grounds in the District of Columbia, 2769; underground wires for telegraph and telephone service to connect the several Departments and Bureaus of the Government in Washington City, 2794; Washington Monument, 2799.

APPENDIX A A A.

REPORT OF MAJ. CHARLES J. ALLEN, CORPS OF ENGINEERS.

CONSTRUCTION and improvement of roads and bridges in the Yellowstone National Park 2803

APPENDIX B B B.

THE NORTHERN AND NORTHWESTERN LAKES.

ANNUAL WATER LEVELS 2807

REPORT OF LIEUT. COL. O. M. POE, CORPS OF ENGINEERS.

Issue of published charts 2810

APPENDIX C C C.

EXPLORATIONS AND SURVEYS IN DIVISIONS AND DEPARTMENTS.

REPORT OF CAPT. WILLIAM L. MARSHALL, CORPS OF ENGINEERS.

Engineer operations in the Division of the Missourri 2813

REPORT OF LIEUT. WILLIAM C. LANGFITT, CORPS OF ENGINEERS.

Engineer operations in the Department of the Columbia 2816

REPORT OF LIEUT. JAMES E. RUNCIE, FIRST ARTILLERY, ACTING ENGINEER OFFICER.

Engineer operations in the Division of the Pacific 2817

REPORT OF LIEUT. H. M. CHITTENDEN, CORPS OF ENGINEERS.

Engineer operations in the Department of the Platte 2818

LAWS AFFECTING THE CORPS OF ENGINEERS, FIFTIETH CONGRESS, FIRST SESSION, 1887-'88 2821

APPENDIXES

TO THE

REPORT OF THE CHIEF OF ENGINEERS,

UNITED STATES ARMY.

(CONTINUED.)

APPENDIX U U.

REPORTS OF THE MISSISSIPPI RIVER COMMISSION.

U U 1.

REPORT OF OPERATIONS FROM JULY 1 TO NOVEMBER 1, 1887.

THE MISSISSIPPI RIVER COMMISSION,
PRESIDENT'S OFFICE,
New York, December 16, 1887.

SIR: To bring up the record of the Mississippi River Commission to November 1, 1887, I have the honor to submit the following report of operations since the close of the last fiscal year:

SURVEYS.

For want of means no field work has been attempted. A small number of assistants have been engaged in the work of reducing and preparing for publication the material already at hand. I can not too strongly represent the necessity, which the secretary of the Commission in his annual report urges, of an early and liberal provision for securing in permanent form information now only in manuscript or in the original note-books, and liable at any time to entire and irrecoverable loss. The work now being done will have to be curtailed before the close of the present fiscal year.

CONSTRUCTION.

At the meeting of the Commission held June 30 to July 2, 1887, previous allotments which had not been approved were canceled, and the greater portion of the sum devoted to them reallotted to levee construction, leaving such amounts as were thought necessary for the care of plant, office expenses, surveys, and protection of existing works, as appears in the following statement:

WITHDRAWN FROM ALLOTMENT.

For Plum Point Reach:	
Fletcher's revetment	$180,000
Elmot and Island 30 dikes	130,000
Unassigned balance	27,250
For Lake Providence Reach:	
Pilcher's revetment (repairs)	135,000
Pilcher's revetment (extension)	40,000
Cottonwood, Lake Providence, and Baleshed dikes	67,140
For the general service	45,000
Unallotted balance	69,000
Total	693,390

REALLOTTED.

For care of plant, first and second districts, from October 1, 1886, to June 30, 1888	$45,
For surveys, first and second districts	10,
For maintenance of existing works, first district	27,
For levees, Plum Point Reach, west bank	75,
For care of plant and surveys, third district, from October 1, 1886, to June 30, 1888	45,
For protection of existing works, third district	25,
For protection of Delta Point	10.
For levees, White River front	75,
For levees, Tensas front	321,
For Robinsonville levee, Yazoo front	60,
Total	693,

FIRST DISTRICT.

The contraction works in Plum Point Reach have been almost co stantly above water, and consequently exposed to no attacks. Th middle section of revetment at Fletcher's is still in place, although i nearest supports are about 5,000 feet distant on either side. From th fact that whatever loss has occurred here has been from caving abov and below, allowing this widely detached section to be taken in flank, Captain Leach is led to believe that the protection of banks caving only at a moderate rate may be effected by discontinuous revetment at large saving in cost.

The exceptional low water of the past season has given an opport nity to judge of the effect of the improvement at Plum Point Reach b comparison with unimproved parts. Before work had been done he Bullerton Bar, at the stage of water prevailing this season, would no have given more than 4½ feet of water. During this low water ther has never been less than 9 feet on the reach, while in the remaining 40 miles of the first and second districts there are about twenty crossing ranging from 8 feet to 5½ feet in depth.

Levees, first district.—Owing to favorable weather, the low price o labor, and the fact that the work required is lighter than was expected the extent of line on the west bank, which will be closed by the allot ment of $75,000, will considerably exceed the estimate. About 22 miles will be constructed. The work is in progress under two contracts, a 14¾ cents and 15½ cents per cubic yard, respectively.

SECOND DISTRICT.

The channel works have been confined to the vicinity of Memphis Tenn., and consist exclusively of shore protection. The work in Memphis Harbor is now complete, no part of the revetment made under the plans of the Commission having suffered the slightest disturbance. By this work, and by the citizens' bluff protection, constructed on the plans and under the supervision of Captain Leach, the whole city front is considered perfectly secure. The revetment placed here by the United States is the heaviest and most costly work of the kind ever done. Including all the mishaps of the experimental stage, its cost has been about $30 per linear foot of bank, though, with methods of construction now in use, the cost of similar work should not exceed $25 per foot. Captain Leach says, "* * * it will certainly protect any alluvial bank on the Mississippi River, no matter how difficult." As will be seen later, the cost of revetment in ordinary cases will not exceed two-thirds of this, and may be even much less.

Since July 1 an allotment of $60,000 for extension of the revetment Hopefield Bend, above the city, has become available. It was ex- pted that this sum would be required for protecting 3,000 feet of bank; t from a concurrence of favoring circumstances, and more especially a result of acquired experience, it is now certain that from 25 to 30 r cent. more work will be effected than was contemplated. The work s suffered no recent loss; but constant caving of the unprotected nk takes place, and the revetment should be extended about 2,000 t below the point which will be reached under the present allot- nt.

Levees, second district—Yazoo Front.—An allotment of $60,000 was de, conditioned upon a contribution from the levee district of a sum ficient to complete the line. The conditions have been accepted by e levee board; but for financial and other reasons they do not think expedient to begin the work before the next low water.

Levees—White River Front.—An allotment of $75,000 was made to uild the levee from Helena down, conditioned upon the contribution $50,000 by the cotton-belt levee district of Arkansas. The condition ving been complied with, contracts for the parts to be built by the ited States have been made at an average price of 16¼ cents per bic yard.

THIRD DISTRICT.

Lake Providence Reach.—Work has been confined to care of plant d minor repairs; no change in the condition of the channel works is ported. On account of the unfinished state of the works this reach not in as satisfactory condition as Plum Point Reach. At Stack and Crossing, where the channel is inclined to divide more than else- ere, the least depth reported was 7 feet. This, it is true, was only r a few days, the depth at a lower stage of water being not less than et. At other crossings on the reach the least depth has been 11 feet more.

Vicksburg Harbor.—It is expected that with the available allotment e canal will be dredged to the plane of 18 feet on the gauge, but as e river has, since the approval of the project, remained below that ge, work has been impossible. A contract has, however, been made 18 cents per cubic yard, and the work will begin so soon as the stage f water will permit.

The revetment at Delta Point has remained without change, but e caving is taking place above it, which, although at present favora- le to the protection of the point itself, may in the future make it ecessary to extend the work up-stream.

Greenville Harbor.—The approved project for spending the allotment f $37,500, together with $42,500 contributed by the city of Greenville, ntemplates a system of ten sloping spurs, similar to those built at New rleans and Memphis, along about 5,000 feet of bank. Two of these e completed, two more in progress, and it is expected that the whole ries will be finished before high water.

Levees—third district.—Under the allotment by the Board of Engi- eers on Levees, made July 2, 1887, of $56,500 for the Opossum Fork evee, and that made July 25 of $155,083 for building and repair of levees, nsas front, Arkansas, contracts have been made at prices varying m 16 to 28 cents per cubic yard. In co-operation with the local levee ards work is in progress along the line, with a fair prospect of completion before the next high water.

FOURTH DISTRICT.

New Orleans Harbor.—A survey of Gouldsboro Bend shows tha
far as completed, the works have accomplished their purpose of hol
the bank and preventing caving, although no marked deposit is
served. Preparations have been made for the authorized extensio
the protection and work will begin at once.

Red and Atchafalaya rivers.—Since July 1 over $13,000 has been
pended in an ineffectual attempt to keep open the channel of Red
from the Mississippi to the Atchafalaya. Both the Red and Missis
were at an unusually low stage through the season, and the absenc
current in Old River prevented the removal by scour of material sti
up by scraping or other means. It seems certain that annual dredg
can not be relied on to keep open this channel at a justifiable cost.

In the Atchafalaya River seven mats for the first sill have been
covering a length of 560 feet. These mats are each about 80 by
feet, and 3 feet thick, loaded with over 400 tons of stone. The
tractors having failed to supply stone as required, the Governm
plant and hired labor were used to obtain from the Ouachita
what was needed. Captain Kingman is of opinion that work of
kind can be better and more cheaply done by hired labor than by
tract.

Levees.—The contracts for Deer Park and Kempe levees have been
and work is in progress on both.

Money statement.

Amount available June 30, 1887		$1,372,70
Amount expended present fiscal year, exclusive of liabilities outstanding June 30, 1887	$218,834.38	
Outstanding liabilities November 1, 1887	58,007.34	
Covered by contracts November 1, 1887	614,350.39	
		891,19
Balance available November 1, 1887		481,51

Herewith are sent copies of the reports upon the first and sec
districts, containing details of interest.

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers, Bvt. Maj. Gen. U. S. A.,
President Mississippi River Commissio

The SECRETARY OF WAR.
(Through the Chief of Engineers.

[Indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 22, 1887.

Respectfully transmitted to the Secretary of War with inclosures.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

EPORT OF CAPTAIN S. S. LEACH, CORPS OF ENGINEERS, UPON OPERATIONS IN THE FIRST DISTRICT.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., November 15, 1887.

GENERAL: Pursuant to the requirements of section 4 of the river and rbor act of August 5, 1886, I have the honor to submit herewith a re- rt to November 1, 1887, of the "work done, contracts made, the ex- nditures thereunder or otherwise, and balances of money on hand up November 1, and the effect of such work," so far as relates to the rtion of the works in my charge embraced in the first district.

The district extends from Cairo, at the mouth of the Ohio, to the foot f Island 40, a distance of 220 miles. The only place in the district here actual work has ever been undertaken is the Plum Point Reach, here, for a distance of 12 miles, beginning 157 miles below Cairo, the ver has been brought under control as to its channel and the flood es- pe practically prevented. The extent and location of works have en fully reported on and their condition and the results obtained and aintained have been chronicled from time to time, my last report bring- g the subject down to the close of the last fiscal year.

There has been but little change in the condition of the channel works ince last report. The contraction works have been almost constantly bove water and therefore out of the reach of danger. The bank revet- ents are in the same condition as at last report; that is, they are gen- rally in good order and effective.

The middle section of the Fletcher's revetment, the remarkable endur- nce of which has been repeatedly commented upon in my reports, s still in place. It seems to have suffered little, if any, damage since he last report. It was intended to form part of a continuous revet- ent of the bend, near the middle of which it is situated. In January, 885, work upon it was interrupted from exhaustion of funds, and has ever been resumed. It was left a short, unfinished piece of work, iso- ated in the middle of a rapidly caving bend, with its nearest supports early a mile distant above and below. This short piece of work withstood all front attacks, and only succumbed in part when the caving of he unprotected bank above and below it, to a distance of 400 feet back f its position, caused it to be attacked in rear at both ends. Even under this great disadvantage it has yielded but slowly, and for the last year and a half has protected the entire bend from caving to any pernicious extent. With such pieces of revetment placed at supporting distances of 500 feet instead of 5,000, as in this case, it can not be doubted that the bank will be permanently and effectively prevented from caving. I am, therefore, impelled to repeat with added emphasis the statement made in my report of July 30, 1886, to the effect that caving banks of average difficulty can be protected by discontinuous revetment. I would recommend at the outset that the spaces be equal in length to the revetments, which would effect at once a saving of 50 per cent. in cost.

The low water of this year has been unusual, both in its small volume and prolonged duration. As a consequence, commerce has suffered greatly from obstructed navigation. At present the load draught of boats running from Cairo down is limited to less than 5 feet by a crossing at Phillips, 50 miles below, where the most careful search with a sounding-pole has discovered no greater depth than 5 feet 2 inches. Besides this, pilots are now reporting on the 400 miles of river, com-

prising the two districts in my charge, the following bad places: F
of 6 feet depth, one of 6½, nine of 7, two of 7½, and 5 of 8 feet, mak
a grand total of twenty-two places in half the river where the nav
ble depth does not exceed 8 feet. Before the improvement was be
at Plum Point, Bullerton Bar was notoriously the worst one be
Cairo and could be depended upon to give a foot less water than
other crossing. It is conceded by all informed river-men that in suc
water as this no more than 4½ feet could have been found there. In
improved condition the actual depths, determined frequently and w
care, have never fallen below 9 feet, thus making this place twice
deep as formerly, and better than twenty-two other places which u
to exceed it in depth.

This season, for the first time in the history of the work, the discha
of the river at the lowest stage was entirely through the regula
channel.

Levees.—At the last meeting of the Commission an allotment
$75,000 was made for "Levees Plum Point Reach, west bank."
allotment was made in the belief that it would cover but a part of
reach, but the survey showed the quantities to be less than had b
assumed, and this, with the very low prices obtained, so much incre
the length of line which could be covered with the money, that a st
ard levee will be built from the intersection of Mill and Bear bay
opposite Ashport, to a connection with the old levee on Craighead Po
a distance of 22 miles, or nearly double the improved portion of
reach. The old levee, with which a junction is effected at the lower
is 8 miles long and in fair condition. The few breaks will be put up
the planters behind it, and its length will be added to the 22 m
mentioned, so that the application of this allotment closes 30 miles
the Saint Francis front against the escape of flood waters from
river.

Proposals for the work were opened September 20, and were as
lows:

Abstract of proposals for levee work on Plum Point [illegible] *20, 1887, by Capt. Smith S. Leach, Corps of Engineers.*

Name of bidder.	Earth-work per cubic yard on sections.																							Felling timber (per acre).	Sodding (per square yard).	Remarks.
	South.																			North.						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4			
	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.	Cts.			
J. S. Grant, J. K. Jeffries, and C. A. Dameron, Nebletts, Miss.	22⅛	22⅛	22⅛	23⅛	21½	24½	24½	24½	24½	24½	24½	....	....	....	21⅛	21⅛	21⅛	21⅛	21⅛	23⅛	23⅛	23⅛	23⅛	$35	$0 01½	
J. A. Forrest and George B. Forrest, Memphis, Tenn.	...	....	....	....	....	....	....	....	....	....	....	....	....	....	18⅛	19⅝	20⅞	20⅜	19⅞	....	....	...	....	60	.01½	
Aylette R. Fudge, Memphis, Tenn.	21	21	20	19	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	17⅛	20	20	19	....	....	....	....	85	.02 01	Sections 5 to 16. Other sections.
J. J. Cooney, Memphis, Tenn.	16⅝	16⅝	16⅝	16⅝	....	....	....	....	....	19	19	....	...	....	15	18	16⅛	16⅛	16⅛	....	....	....	....	40	.01	
William B. Strang, jr., Memphis, Tenn.	....	....	....	....	16	16	16	16	16	16	16	16	16	16	16	....	....	....	....	....	....	....	....	40	.01	
John S. McTighe and L. L. Mackee, Memphis, Tenn.	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	50	.01½	
C. H. Dishman, president Central Construction Co., Henderson, Ky.	17⅞	17⅞	17⅞	17⅞	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	17⅞	17⅞	17⅞	17⅞	50	.01	
Serbian, Wright & Co., Cairo, Ill.	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	15⅛	40	.01½	
Joseph C. Neeley, Bardwell, Ky.	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	....	..	19⅞	19⅞	19⅞	19⅞	60	....	
Thomas F. Duffin and Henry Duffin, Memphis, Tenn.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	40	.01	
J. T. Jefferson, Memphis, Tenn.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	....	....	....	....	50	.01	
Robert Johnson, Memphis, Tenn.	...	....	....	....	....	....	....	....	....	....	....	....	....	....	....	...	....	...	....	....	....	...	....	40	.01½	18 cents. Section numbers not given.
J. W. Jefferson & Co., Memphis, Tenn.	....	....	....	....	....	19	18½	18	17⅛	17	....	....	....	....	....	....	....	....	....	....	...	....	....	42	....	
J. E. Richards, Memphis, Tenn.	....	....	....	....	....	...	....	....	....	....	....	....	....	....	....	....	....	....	....	18	18	25	34	25 75	.01½	Nos. 1 and 2. Nos. 3 and 4.
George Arnold and W. O. Flynn, Memphis, Tenn.	....	....	....	....	....	....	....	....	....	....	...	....	....	....	....	....	....	....	....	....	....	....	....	65	.02	21½ cents. Section numbers not given.
John A. Cannon and T. O'Hara, Greenville, Miss.	....	....	....	..	...	....	....	....	...	...	...	....	....	....	18	18	18	18	18	....	....	....	....	S. B. 10 H. C. 75 L. C. 85	.02	
W. E. Smith and Thomas Foley, Memphis, Tenn.	....	....	....	....	...	....	....	....	....	....	....	....	....	..	23	23	23	23	23	....	....	....	....	S. B. 10 85	....	
Timothy Sullivan, Memphis, Tenn.	18	18	18	18	21	21	21	21	21	21	21	21	21	21	14¾	14¾	14¾	14¾	14¾	19	19	19	19	40	.03	
Reese Thomas, Memphis, Tenn.	....	....	....	....	...	....	....	....	....	....	....	....	....	....	17½	17½	17½	17½	17½	....	..	...	...	45	.01½	
Hugh Foran, Memphis, Tenn.					24	24	24	24	24	24	....	....	....	....	....	..	....	..	..	....				100	.01½	

The award was made to the lowest bidders, Serbian, Wright & of Cairo, Ill., sections 1 to 4, inclusive, north, and sections 1 to 14, clusive, south, at 15½ cents; and Timothy Sullivan, of Memphis, Te sections 15 to 19, inclusive, south, at 14¾ cents.

Work is now in rapid progress.

A table of depths and velocities observed on the Plum Point Rea July, 1886, to November, 1887, is herewith; also detailed statements expenditures and financial statements and general balance-sheet for t district.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Captain of Engineers.

General Q. A. GILLMORE,
President Mississippi River Commission.

Table showing comparative least-channel depths and velocities in various channels of improved portion of Plum Point Reach, Mississippi River.

Localities.		First group.						Second group.					
		Lower Plum Point Crossing.		Bullerton Channel.		Bullerton Chute.		Lynch's.		Island No. 30 Channel.		Elmot Chute.	
Date.	Gauge.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.
1886.	*Feet.*												
July 6	17.15	......	......	15.0	......	....	....	18.0	......	23.5	......	....	....
9	14.90	24.0	4.70	14.0	3.17	....	0.94	16.0	......	21.0	4.78	....	3.79
13	12.65	19.5	4.83	13.5	3.30	....	0.81	14.5	......	20.5	4.33	....	3.30
16	11.70	18.5	5.28	13.0	3.04	....	0.90	14.0	......	20.0	5.28	....	....
19	10.35	17.0	......	12.0	......	....	......	12.0	......	19.0	......	....	....
23	8.50	17.0	5.12	10.0	3.34	....	0.64	......	......	17.0	4.29	....	....
26	7.15	15.0	5.16	7.5	3.59	....	0.60	8.5	......	17.0	4.54	....	....
30	5.75	14.5	......	6.5	......	....	......	8.5	......	16.0	......	....	....
Aug. 9	4.30	11.0	4.95	5.5	3.46	....	......	5.5	3.63	11.0	5.12	....	....
18	4.00	13.0	5.33	6.0	3.09	....	......	8.5	4.41	14.0	4.29	....	....
25	4.25	13.5	......	6.5	......	....	......	7.5	......	13.0	......	....	....
28	4 80	13.5	4.70	6.5	2.88	....	......	9.5	3.96	13.0	4.46	....	....
Sept. 2	4.50	13.5	4.87	5.5	3.00	....	......	8.5	4.37	13.5	4.50	....	....
7	3.35	12.0	5.04	4.5	3.42	....	......	7.0	3.54	12.0	4.12	....	....
20	1.75	10.5	4.95	......	......	....	......	......	......	10.0	3.88	....	....
24	1.90	10.0	4.37	......	......	....	......	......	......	10.0	3.92	....	....
29	1.65	10.5	4.91	......	......	....	......	......	......	10.5	4.17	....	....
Oct. 4	1.90	10.5	4.83	......	......	....	......	......	......	10.0	4.12	....	....
9	2.65	12.0	4.66	......	......	....	......	......	......	11.5	3.87	....	....
15	2.00	12.5	3.30	......	......	....	......	......	......	10.5	3.67	....	....
22	0.65	10.0	3.88	......	......	....	......	......	......	9.0	3.83	....	....
25	0.35	11.0	3.71	......	......	....	......	......	......	8.5	3.96	....	....
Nov. 10	0.10	10.5	3.30	......	......	....	......	......	......	8.5	3.46	....	....
12	0.10	13.0	......	......	......	....	......	......	......	9.0	......	....	....
16	0.05	12.0	3.79	......	......	....	......	......	......	9.0	3.75	....	....
19	0.20	13.0	3.88	......	......	....	......	......	......	9.5	3.59	....	....
30	12.80	29.0	4.04	15.0	2.63	....	......	19.0	4.17	22.0	4.75	....	....
Dec. 10	7.15	21.5	3.63	9.0	2.34	....	0.69	10.0	3.62	17.0	3.75	....	....
17	3.75	19.0	3.55	......	......	....	......	......	......	13.0	3.88	....	....
1887.													
Jan. 14	6.45	19.5	4.04	......	......	....	......	......	......	13.0	4.17	....	....
20	5.00	......	......	7.0	3.43	....	......	7.0	4.18	......	......	....	....
26	8.50	22.5	4.30	10.5	3.50	....	......	10.5	3.26	16.5	4.47	....	....
31	18.70	33.5	4.87	22.0	......	....	1.14	21.5	3.92	28.0	4.62	....	....
Feb. 9	27.90	42.0	4.87	30.0	4.16	....	3.00	31.0	5.20	38.5	4.79	....	....
19	31.22	44.0	5.24	32.0	3.63	....	2.79	34.0	5.74	41.0	4.50	....	....
28	32.10	45.5	5.37	32.0	3.17	....	......	32.5	5.41	43.5	4.00	....	....
Mar. 5	32.29	......	......	31.0	4.29	....	2.95	......	......	......	......	....	....
7	32.40	46.5	4.84	......	......	....	......	32.0	5.18	45.0	4.58	....	3.90

le showing comparative least-channel depths and velocities in various channels of the improved portion of Plum Point Reach, Mississippi River—Continued.

Localities.		First group.						Second Group.							
		Lower Plum Point Crossing.		Bullerton Channel.		Bullerton Chute.		Lynch's.		Island No. 30 Channel.		Elmot Chute.		Island No. 30 Chute.	
Date.	Gauge.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.
r. 18	32.20	45.0	5.36	34.0	3.93	....	2.96	32.5	5.19	......	......	....	....	....	5.03
19	32.03	......	......	......	......	....	......	......	......	44.0	5.33	....	....	....	....
31	16.50	27.0	......	15.5	......	....	2.40	......	......	30.0	......	....	....	....	....
r. 7	15.94	27.0	......	13.5	......	....	......	15.5	......	28.5	......	....	....	....	....
11	14.00	26.0	......	12.5	......	....	1.60	13.5	......	27.0	......	....	....	....	....
29	23.80	36.5	6.06	24.0	3.46	...	3.02	24.0	5.74	37.0	5.82	....	....	....	....
y 9	24.90	37.0	5.29	24.5	3.50	....	2.91	23.5	4.84	28.0	4.82	....	....	....	....
17	16.40	28.5	4.76	14.5	2.95	....	1.99	14.5	3.30	29.0	5.95	....	....	....	....
24	14.80	25.0	4.49	13.0	2.85	....	1.77	14.0	4.21	26.0	5.92	....	....	....	....
ne 1	9.80	18.0	4.30	6.5	2.36	....	0.81	8.0	3.08	18.0	4.74	....	....	....	....
17	11.30	20.0	4.25	9.0	2.17	....	1.24	10.0	4.03	24.0	5.20	....	....	....	....
23	12.80	24.0	4.48	9.5	2.93	....	1.15	11.0	3.99	25.0	4.76	....	....	....	....
27	9.70	20.0	4.18	......	......	....	1.00	......	......	23.0	4.60	....	....	....	....
ly 1	8.40	17.5	3.76	......	......	....	0.96	......	......	21.0	5.87	....	....	....	....
6	8.53	17.0	4.14	5.0	2.44	....	0.65	7.0	4.14	20.5	5.31	....	....	....	....
11	8.40	17.0	4.33	4.5	2.17	....	1.03	7.0	3.70	22.0	5.27	...	....	....	....
18	6.50	16.5	4.06	......	......	....	0.96	......	......	19.0	5.12	....	....	....	....
22	4.90	13.5	4.52	......	......	....	0.85	......	......	18.0	4.85	....	...	....	....
27	3.80	11.5	4.01	......	......	....	0.66	......	......	14.5	4.50	....	....	....	....
g. 1	3.20	11.0	4.17	......	......	....	0.52	5.5	......	16.0	4.17	...	....	....	....
8	2.05	11.5	4.36	......	......	....	......	......	......	15.0	4.21	....	....	....	....
13	1.80	10.5	4.48	......	......	....	0.44	......	......	15.0	4.29	..	....	...	....
22	1.40	10.5	4.37	......	......	....	......	5.0	4.30	14.5	3.57	....	...	....	....
29	0.45	9.0	4.44	......	......	....	......	......	......	12.0	3.50	...	....	....	....
t. 7	0.45	11.0	4.22	......	......	....	......	4.5	4.06	13.0	4.12	....	....	....	....
9	0.20	10.5	4.59	......	......	....	......	......	......	13.0	4.78	....	....	....	....
13	—0.35	9.5	4.92	......	......	....	......	......	......	11.0	4.92	....	...	....	....
17	0.60	10.5	4.74	......	......	....	......	5.0	3.90	13.0	4.59	....	....	....	....
21	0.50	10.5	3.53	......	......	....	0.30	......	......	12.0	4.15	....	....	....	....
26	2.00	12.5	3.80	......	......	....	0.50	6.0	3.67	13.0	4.22	....	....	....	....
t. 3	0.45	10.0	4.19	......	......	....	0.38	......	......	11.0	3.85	....	....	....	....
8	0.10	10.5	4.08	......	......	....	......	4.5	3.27	11.0	3.72	....	....	....	....
14	—0.55	9.0	3.95	......	......	....	......	......	......	10.5	3.53	....	....	....	....
17	—0.70	10.0	4.03	......	......	....	......	4.0	3.53	9.0	3.49	....	....	....	....
27	—1.65	9.0	4.03	......	......	....	......	3.0	3.42	9.0	3.28	....	....	....	....

NOTE.—The depths reported are the least found in the line of deepest water, or those which limited navigation for the time being. The velocities were measured on the same line and near the shoalest point. They were all taken with the current meter running at a depth of 5 feet below the surface. They are individual velocities, taken to ascertain the relative draught of water in the different channels, and are useful for that purpose only. They have no relation to the average velocity or discharge.

The crossings forming Group 1 of the table may be considered as competitors for the channel over Bullerton Bar. The third, Bullerton Chute, was completely closed by works; the second, Bullerton Channel, has remained partly obstructed by the diverting action of the works favoring the first channel, which latter has remained good by reason of carrying the water diverted from the other two.

The four channels of the second group are also competitors, of which the third and fourth have been restricted in discharge by the Gold Dust dikes, and the first by the directive action of the Fletcher's revetment. The second, Island 30, has carried the bulk of the water and has remained good.

Appropriation for improving Mississippi River, first district.

FINANCIAL STATEMENT.

Balance on hand June 30, 1887, as per last report		$376,947.
Amounts received since:		
Overpayment refunded	$6.00	
Re-allotted by Mississippi River Commission, viz:		
Levees, Plum Point Reach, west bank	75,000.00	
Protection of existing works, first district	27,250.00	
Received from allotment for "care of plant, first and second districts," to cover expenditures from October 1, 1886, to June 30, 1887	19,994.00	
		122,25
Total		499,197.
Expended from July 1 to October 31, 1887, viz:		
On account of Plum Point Reach	2,866.04	
On account levees, Plum Point Reach	1,579.80	
Re-allotted by Mississippi River Commission	337,250.00	
		341,695.
Balance October 31, 1887		157,501

General balance-sheet.

PLUM POINT REACH.

Dr. Cr.

1887. June 30	To balance	$326,301.25	1887. July 2	By amount reallotted by Mississippi River Commission.	$337.25
April 11	To overpayment refunded	6.00	Oct. 31	By amount expended from July 1, 1887, to date.	2,86
July 2	To amount received from allotment for "care of plant, first and second districts."	19,994.00	Oct. 31	By balance	6,18
		346,301.25			346,30

LEVEES, PLUM POINT REACH.

1887. June 30	To balance	$13,146.34	1887. Oct. 31	By amount expended from July 1, 1887, to date.	$1,57
July 2	To amount allotted to levees, Plum Point Reach, west bank.	75,000.00	Oct. 31	By balance	86,56
		88,146.34			88,14

HICKMAN, KY.

1887. June 30	To balance	$18,750.00	1887. Oct. 31	By balance	$18,750.

COLUMBUS, KY.

1887. June 30	To balance	$18,750.00	1887. Oct. 31	By balance	$18,750.

FIRST DISTRICT.

isbursements made under appropriation for improving Mississippi River, act of August 5, 1886.

[November 1, 1886, to November 1, 1887.]

Contracts made with—	For what made.	Disbursements under contract.	Liabilities under contract.	Total.
Fritz	Metal roofing	$6, 619. 40		$6, 619. 40
S. McTighe & Co	Levee work	82, 772. 89		82, 772. 89
mothy Sullivan	do		$75, 000. 00	75, 000. 00
rbian, Wright & Co	do			
		89, 392. 29	75, 000. 00	164, 392. 29

Disbursements otherwise than under contract.

For what expended.	By public notice and sealed proposals.	In open market.	Liabilities.	Total.
aterial and supplies	$10, 857. 77	$4, 556. 38		$15, 414. 15
bsistence and supplies	2, 077. 45	1, 940. 46		4, 017. 91
rvices		29, 454. 46		29, 454. 46
iscellaneous	263. 83	1, 029. 15		1, 292. 98
	13, 129. 05	36, 960. 45		50, 179. 50

SMITH S. LEACH,
Captain of Engineers.

Appropriation for improving Mississippi River, first and second districts.

FINANCIAL STATEMENT.

mounts allotted by Mississippi River Commission on July 2, 1887, viz:		
Care of plant, first and second districts	$45, 000. 00	
Surveys, first and second districts	10, 000. 00	
		$55, 000. 00
xpended from July 1 to October 31, 1887, viz:		
Transferred to allotment for Plum Point Reach to cover expenditures for care of plant from October 1, 1886, to June 30, 1887	19, 994. 00	
Expended on account, care of plant	6, 315. 42	
Expended on account, surveys	480. 35	
		26, 789. 77
Balance, October 31, 1887		28, 210. 23

General balance-sheet.

CARE OF PLANT.

Dr.				Cr.	
1887. uly 2	To amount allotted by Mississippi River Commission.	$45, 000. 00	1887. July 2	By amount transferred to allotment for Plum Point Reach, to cover expenditures for care of plant, October 1, 1886, to June 30, 1887.	$19, 994. 00
			Oct. 31	By amount expended from July 1, 1887, to date.	6, 315. 42
			Oct. 31	By balance	18, 690. 58
		45, 000. 00			45, 000. 00

General balance-sheet—Continued.

SURVEYS.

1887. July 2	To amount allotted by Mississippi River Commission.	$10,000.00	1887. Oct. 31	By amount expended from July 1, 1887, to date.	$481.
			Oct. 31	By balance	9,519.
		10,000.00			10,000.

FIRST AND SECOND DISTRICTS.

Disbursements, otherwise than under contract, made under appropriation for impro Mississippi River, act of August 5, 1886.*

[November 1, 1886, to November 1, 1887.]

For what expended.	By public notice and sealed proposals.	In open market.	Liabilities.	Total.
Material and supplies	$79.82	$21.29	$123.45	$224.
Subsistence supplies	776.97	463.12	157.18	1,397.
Services		5,197.49	1,602.70	6,800.
Miscellaneous		257.08		257.
	856.79	5,938.98	1,883.33	8,679.

SMITH S. LEACH,
Captain of Engineers.

---

* No contract made.

Itemized statement of expenditures, improving Mississippi River, first and second distric October 1, 1886, to October 31, 1887.

Articles.	Repairs to plant.		Care of plant.		Repairs to Plum Point dikes.	Surveys and examinations.	Total
	First district.	Second district.	First district.	Second district.			
Lumber	$736.21	$46.00	$4.89	$1.25			$788.
Oakum	391.26	101.19	2.80				495.
Nails	43.13	3.83	.92	.57			48.
Spikes	27.82	.40			$55.62		83.
Iron	308.96	28.31	15.93	12.28			365.
Pipe-fittings	98.53	7.82		1.14			107.
Paint	255.45	42.99	27.60	12.93			338.
Coal	220.34	23.38	457.06	313.16	261.80	$210.98	1,486.
Rope			369.65	184.82	31.06	8.80	594.
Salt			117.50	58.75			176.
Piling			30.00	15.00	1,274.11		1,319.
Wire					665.62		665.
Miscellaneous	337.20	27.18	91.88	50.21	34.78	13.22	554.
Labor	9,418.85	1,354.85	9,771.59	4,991.27	2,642.19	2,430.62	30,609.
Totals	11,837.75	1,635.95	10,889.82	5,641.38	4,965.18	2,663.62	37,633.

SMITH S. LEACH,
Captain of Engineers.

REPORT OF CAPTAIN S. S. LEACH, CORPS OF ENGINEERS, UPON OPERATIONS IN THE SECOND DISTRICT.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., November 15, 1887.

GENERAL: Pursuant to the requirements of section 4 of the river and harbor act of August 5, 1886, I have the honor to submit herewith a report to November 1, 1887, of the "work done, contracts made, the expenditures thereunder or otherwise, and balances of money on hand up to November 1, and the effect of such work," for such of the works in my charge as are embraced in the second district, Mississippi River. The district extends from the foot of Island 40 to the mouth of White River, a distance of 175 miles. But a small part of it has been the scene of actual work. The channel works have been confined to the vicinity of Memphis, and, with certain levees built in Mississippi and Arkansas, constitute all that has been done in the district.

The channel works have been exclusively of the type known as revetment, or structures designed to prevent the caving of the banks. They have been carried on under the official designations of Memphis Harbor and Memphis Reach.

MEMPHIS HARBOR.

The object of this work has been the protection from destruction by the encroachment of a rapidly-caving river bank of extensive sites and costly structures, such as warehouses, elevators, cotton compresses, and a valuable paved landing, which, by affording terminal facilities unexcelled by any port on the river, were of marked benefit to the maritime commerce of Memphis, and hence to that of the river at large. As this work is now completed and to all appearances entirely successful, a résumé of its history seems appropriate. Prior to 1873 the portion of the river bank constituting the harbor front of Memphis was comparatively stable. In 1876 it had receded 350 feet and continued to cave at the rate of 100 feet per annum. The next year (1877) the engineer officer in charge was directed to make a survey and to report upon the feasibility of affording relief from the impending danger. He submitted a plan for the prevention of further caving by revetting the bank with willow mattresses ballasted with stone. This revetment it was proposed to form of mattresses 130 feet long, 55 feet wide, and 2½ feet thick. They were built at a suitable place, floated to their proper sites, and sunk side by side. The upper end of each was about at low water-line, and it covered 55 feet of bank for a distance of 130 feet from that line. From the low-water line to that of a stage 10 feet above low water the bank was to be covered with a layer of brush and stone, similar in construction to the later work. Revetment work was then in the earliest stage of its development, and although this was a distinct advance beyond anything previously projected, it possessed several serious defects, which are easily observable by comparison with the class of work now considered standard. The project was approved, and appropriations aggregating $113,000 were made for its execution in 1878, 1879, 1880, and 1881. After the first season the work began to show signs of weakness and the caving recommenced, but at a few points only and very slowly. The last season's work was devoted entirely to repairs of that previously done, and at its close the whole enterprise was still in a precarious condition.

By a provision of the river and harbor act of August 2, 1882, this work passed into the control of the Mississippi River Commission, and they made an allotment of $25,000 from that appropriation to ext and repair the revetment, as the decline of the preceding flood had vealed a situation still more alarming. In making these repairs original plan was modified by extending the upper bank protectio high water. The allotment sufficed to do small patches of work at most urgent points, and only postponed the danger. The river and h bor act of July 5, 1884, contained a provision for the expenditur $200,000 in the protection of Memphis Harbor. With this sum av able an opportunity was afforded to abandon the old work and plan a begin anew upon the later and more successful methods which had that time been developed at other points.

The new plan contemplated the protection of the bank by continu revetment from the mouth of Wolf River to the lower end of the pav levee, a total distance of 7,700 feet. Greater efficiency was secured extending the subaqueous mattress 150 to 300 feet from low water against 125 and 130 feet in the old work. Increased stability was tained by carrying a continuous longitudinal bond through the m tress, so that any part receiving too great strain could transfer the cess to adjacent portions above and below, and avoid the destr tion of the work by successive attacks upon isolated pieces. Econo in construction resulted from a decrease in the thickness of the bru work, thus reducing the amount of material required to cover a giv area.

Operations under the new plan were begun at the end of July, 18 under unfavorable conditions. The river was considerably above l stage and rising, with much drift running. The first attempt was build two mats, each 150 feet wide, to be sunk side by side, making protection 300 feet wide. When these were finished, the strong cu rent and accumulation of drift under the outer one made it manifest dangerous to try to sink it as originally intended, and it was dropp down and sunk below its companion. A few days later a mat 300 fe wide was begun, and when 700 feet had been built an attempt to si it was made. During the operation it tore in two, and the parts we sunk separately. This mishap determined the postponement to a mo favorable stage of river of the construction of wide mats, and to gi temporary protection a mattress 150 feet in width was laid from Wo River to Jefferson street, a distance of 4,800 feet, and the correspon ing upper bank work put down. Early in November, 1884, the wid mats were resumed, and under the more favorable conditions the prevailing were built and sunk without loss or difficulty from a poi 400 feet below Wolf River to the middle of the elevator, a distance o 1,600 feet. Their construction was then interrupted by rising wate which put an end to the working season.

The small balance remaining did not justify the resumption of work There remained to be protected the entire length of the city landing which had been graded and paved by the city at a cost of nearly hal a million dollars. Changes in the regimen above had, meanwhile transferred the maximum strain from the vicinity of the elevator to the upper end of this landing, and it began to yield gradually, the pavement from low to high water affording a measure of protection. That the landing was not destroyed before further funds became available I attribute to the fact that Hopefield Point opposite was at that time receding at a very rapid rate, causing the point of greatest strain on this side to travel down stream so fast that there was not time to do great damage at any one place.

The river and harbor act of August 5, 1886, contained an appropriation of $56,250 to complete this work. Operations were resumed in October following. As the late beginning made it improbable that the entire landing could be protected before high water, and as the greatest danger was then at the lower end, the usual order of construction was reversed and the work done from the lower end up-stream.

Four mats were laid during the season, leaving but one more to complete the work. The first, or down-stream one, was 285 feet wide, the next 265, and the rest 250.

In September, 1887, the last mat was laid and the protection was thus made continuous for the entire length originally projected.

The last 3,000 feet of this work has been done since the last detailed report, and an itemized statement of expenditures is submitted with this report. This part required no upper bank protection, the pavement of the city landing taking its place. The junction between the two is not so satisfactory as that between the two parts of a full revetment, and some device for improving this connection may be found necessary, though I think not. Should it be so, however, the balance of funds now on hand will suffice to do whatever is required as well as to make all needful repairs for years to come.

The entire work is to-day in as perfect condition as when built, not a stick nor a stone can be seen to be displaced, and not a foot of earth has been lost behind the revetment. The degree of confidence placed in the work by those most familiar with it may be inferred from the fact that several manufacturing and warehousing concerns on and near the bank have recently erected extensive and costly additions to their buildings. The elevator and compress companies have built out on piles driven through the revetment so as to recover a considerable part of their lost space. The appropriations for the execution of the present project have been $256,250, of which $239,651.35 have been expended. This would make the actual cost of this work about $30 per foot of bank, but this figure is much above the probable cost of future work of the same character. Adequate explanations of the large cost of this particular work will be found in a perusal of the failures and mishaps chronicled above. Taking the last 3,000 feet as a basis for future estimates, it will be seen from the appended statement that the subaqueous work cost less than $12 per foot of bank. For complete work it has been found, both here and elsewhere, that a subaqueous mat 150 feet wide is 50 per cent. of the total cost. These mats were 250 to 300 feet wide, but assuming that the percentage is no more than for the narrower ones, or 50 per cent. of the whole, we should have the cost of completed work less than $24 per foot.

This is the heaviest and most costly work of its kind ever put down, and it will certainly protect any alluvial bank on the Mississippi River, no matter how difficult. These figures, from actual experience, more than justify a prediction which I hazarded before this last part was done, to the effect that work of this character and strength could be put down for $25 per foot. I am now able to state positively that it can be done for less than $25 per foot, which figure may be assumed as the cost of protecting the few banks of very unusual difficulty which may be encountered. For all ordinary banks the cost will be much less.

The work under the first plan described above was done by Maj. W. H. H. Benyaurd. The final repairs to it were made by Maj. A. M. Miller; the new work to Jefferson street was done by Capt. C. B. Sears, and that below Jefferson street by the writer of this report. During the entire execution of the present project Mr. W. M. Rees has served as assistant engineer in local charge with zeal and ability, which ha contributed in no small degree to the success of the work.

MEMPHIS REACH.

This reach extends from the foot of Island 40, 10 miles above Me phis, to Scanlan's Landing, 18 miles below. These 28 miles of riv have for several years been characterized by more than average dif culty of navigation, and were for that reason included, under the tit above given, in the first report of the Commission, as one of the si localities most urgently demanding improvement. In 1882 a compr hensive project for the reach was formulated, and an allotment $300,000 was made from the appropriation of August 2 of that year, provide plant and begin the work. Since that time appropriations hav not justified the allotment of funds for serious prosecution of the ge eral plan, but the necessary small amounts have been applied as the could be spared to secure the unity and safety of the work which wa undertaken under the stimulus of the more liberal appropriation 1882.

The work mentioned is the protection of a caving bank in Hopefiel Bend, immediately above and opposite Memphis. It was intended t serve the double purpose of preventing the river from leaving the har bor of Memphis and of avoiding certain unfavorable changes of regime which that caving, if unchecked, would surely have produced in th river below. Since my report for the fiscal year, an allotment of $60,00 has become available for the extension of this work. A project wa submitted and approved for the application of this sum to the construction of a standard revetment from a junction with the foot of the old work down-stream as far as the money would go. Based on the latest experience, the cost was estimated at $20 per foot of bank, and arrangements were accordingly made for materials to build 3,000 feet. Work was begun early in September, and up to date 3,000 feet of subaqueous work has been laid and half that distance of the upper bank work, with such results as to cost as to make it certain that 25 to 30 per cent more work will be done with this money than was at first thought possible. Prices both of materials and labor are the same as heretofore. This great saving results partly from an unusually favorable season for work, but principally from more rapid progress due to increased experience.

To make this work complete and self-sustaining it should be extended about 2,000 feet below the point which will probably be reached under the present allotment. The old work is in good condition and no losses have occurred in the protected part of the bend, though the rest has been caving continuously and at times rapidly.

LEVEES.

Yazoo Front.—No work has been done on this line since the date of my annual report. At the last meeting of the Commission an allotment of $60,000 was made for a back line from Hushpucana to Malone's Landing, 353 and 357 miles below Cairo, respectively. This allotment was conditioned upon the contribution by the levee district of a sum sufficient to complete the line, estimated to cost $100,000. The conditions of the allotment have been formally accepted by the Levee Board of the Upper Yazoo district. In view of the difficulty of raising the necessary funds during the present fiscal year, which ends February 1, 1888, and the risk attendant upon beginning such an important line, crossing several water-courses, so late in the season, the Board decided to postpone the work until next year and made an appropriation of $7.500 to repair the front line and hold it during the next high water.

White River Front.—At the same meeting of the Commission an allotment of $75,000 was made to rebuild and repair the levee on the White River Front from Helena, Ark., down, conditioned upon the contribution of $50,000 towards the work by the Cotton Belt Levee District, No. 1, of Arkansas, or other parties.

After much delay, resulting mainly from the difficulty of securing the required concert of action among the large owners, many of whom were absent, it was finally decided to proceed under the State laws to assess a tax upon the lands benefited. The necessary valuations and assessments were made, and at a legal meeting held for the purpose a tax of 9 per cent. upon the increased valuation of the lands was voted. Based on the collection of this tax and upon certain individual guaranties, the Board was enabled to make a contract at a reasonable price with a prominent and reliable contracting firm. From this firm I received satisfactory assurances that they would put up unconditionally under their contract $48,000 worth of actual embankment. Allowing, as a moderate estimate, $2,000 for the expense of inspection, which is borne by the Board, this secures the expenditure of $50,000 as required by the Commission. Bids for the United States work were therefore received.

The following is an abstract of them:

Abstract of proposals for levee work on levees, White River Front, received in response to advertisement dated October 8, 1887, and opened October 27, 1887, by Capt. Smith S. Leach, Corps of Engineers, U. S. Army.

Bidders.	Earth-work per cubic yard on section No.—											Felling timber (per acre).	Sodding (per square yard).
	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.		
J. A. Forrest, Memphis, Tenn	....	....	15⅛	15⅛	15	....	....	....	....	....	...	$25	...
Hugh Feran, Memphis, Tenn	....	19⅛	19⅛	....	....	....	....	....	....	....	....	40	1¼c.
Daniel T. Hartnett, Memphis, Tenn	15	14⅞	14⅞	15	15	....	....	....	....	....	....	20	1
Frain-Bambric Con. Company, Saint Louis, Mo	....	20¼	20¼	20¼	20¼	20¼	20¼	20¼	20¼	20¼	20¼	45	1
J. J. Cooney, Memphis, Tenn	16½	15⅜	15⅜	16	16⅞	16⅞	19	19	18	18	20	40	1
Joshua T. Jefferson, Memphis, Tenn	....	16	16	16	16	16	....	....	....	...	....	40	1
A. A. Arnold and C. F. De Garis, Memphis, Tenn	....	17	17	19	17	19	28	28	23	23	20	65	1½
McTighe & Co., Memphis, Tenn	16	15½	15½	15½	15½	17	22	22	18	18	20	30	1
Central Constr. Company, Henderson, Ky	....	16	16	17	18	20	....	....	....	....	....	40	½
A. McDowell, Memphis, Tenn	....	....	....	....	....	16¼	26½	23⅛	23	21	....	60	1
Harvey & Sullivan, Memphis, Tenn	....	16	16	16	16	16	....	....	....	....	....	35	¾
J. K. Jefferies, J. S. Gant, and C. A. Dameron, Nebletta, Miss	15¾	15¾	16¾	16¾	17½	17½	....	....	....	....	....	15	1
T. W. Scott, Memphis, Tenn	..	18½	18½	18½	18½	18½	....	....	....	....	....	40	1
A. M. Stover, Memphis, Tenn	....	16	..	....	....	....	....	....	....	....	....	....	1

The award was made to the lowest bidder on each section, as follows:
Sections 8, 11, and 12 to D. T. Hartnett, at 15 cents.
Sections 9 and 10 to D. T. Hartnett, at 14⅞ cents.
Section 13 to J. T. Jefferson, at 16 cents.
Sections 14 and 15 to J. J. Cooney, at 19 cents
The average price for the line is 16¼ cents.

Contracts have been made with the parties named, and the line will be completed by February 15, 1888.

CITIZENS' BLUFF PROTECTION.

This is practically a continuation by private subscription of the Me phis Harbor revetment. It consists of a series of five spur-dikes brush and stone, resting upon large floor mats, to prevent undercuttin The origin and history of the enterprise and the general plan and ear results of the work are described in full in my annual report. I am no able to present sketches of the general plan and principal details of co struction and the present condition of the dikes and bottom. The is also an itemized statement of the cost of the original dikes.

The repairs and extensions of the system mentioned in my last r port are now in progress. With these finished, it is believed that t system will be complete and self-sustaining until such time as it w no longer be needed.

It will be remembered that the river at this point has not the usu alluvial bank, but flows at the foot of a bluff nearly 100 feet hig Reasons growing out of this circumstance induced the substitution be of the spur-dike for the mattress revetment. The favorable results tained afford an assurance that where the conditions are unfavorable the use of mattress revetment, spur-dikes may, at a slightly great cost, be relied upon to secure the desired result.

Seven sketches of the spur-dikes, detailed statements of expen tures for the same, and for Memphis Harbor, and financial stateme and balance sheet for all works in the district accompany this repo

Very respectfully, your obedient servant,

SMITH S LEACH,
Captain of Engineers.

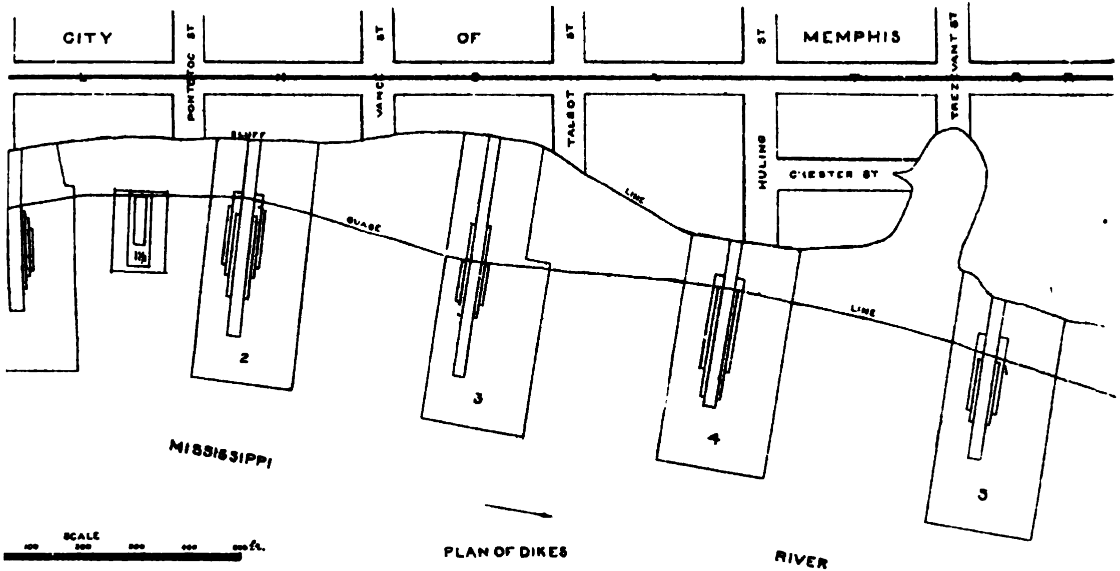
General Q. A. GILLMORE,
President Mississippi River Commission.

CITIZENS BLUFF PROTECTION FUND

OF

MEMPHIS, TENN.

SPUR DIKE REVETMENT
DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGRS. U.S.A.

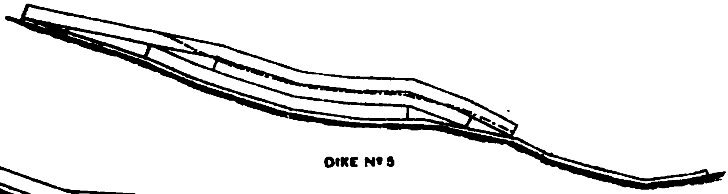


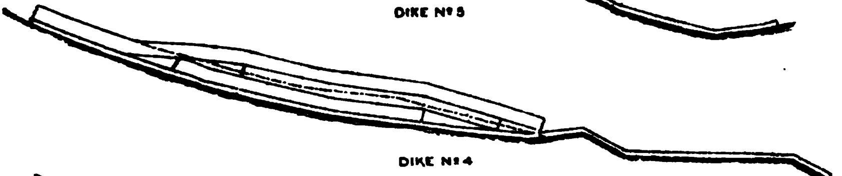
PLAN OF DIKES

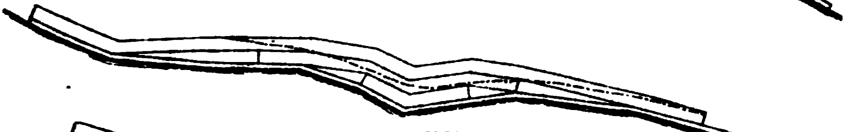
CITIZENS BLUFF PROTECTION FUND
OF
MEMPHIS, TENN.

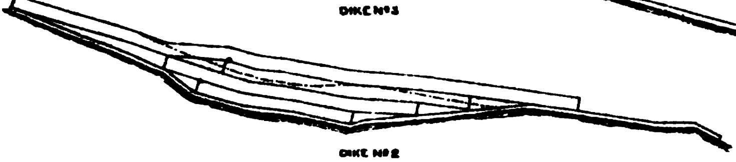
SPUR DIKE REVETMENT
DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGR'S. U.S.A.

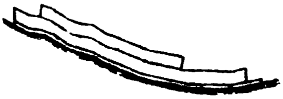
SCALE


DIKE Nº 5


DIKE Nº 4

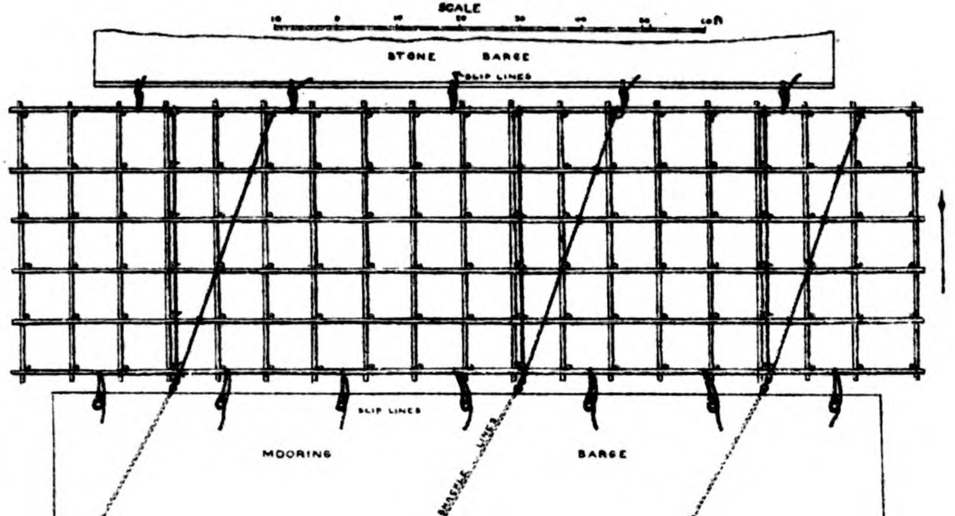

DIKE Nº 3


DIKE Nº 2


DIKE Nº 1½

CITIZENS BLUFF PROTECTION FUND
OF
MEMPHIS, TENN.

SPUR DIKE REVETMENT
DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGRS. U.S.A.



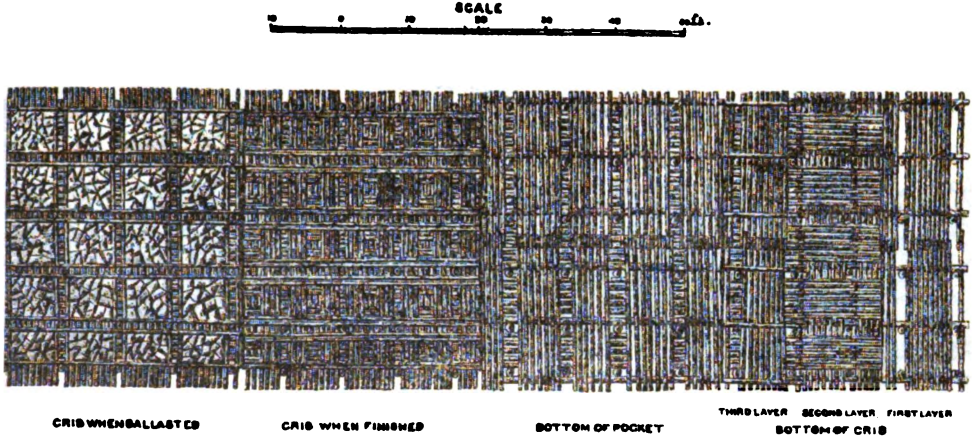
CITIZENS BLUFF PROTECTION FUND

OF

MEMPHIS, TENN.

SPUR DIKE REVETMENT

DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGRS. U.S.A.



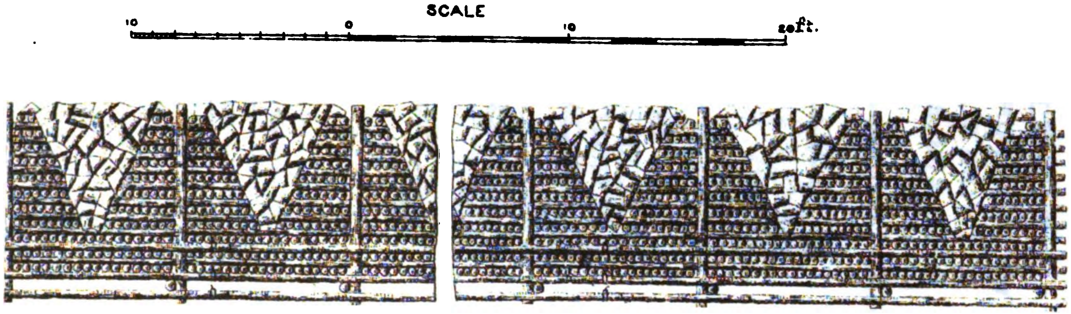
PLAN OF CRIB

TIZENS BLUFF PROTECTION FUND

OF

MEMPHIS, TENN.

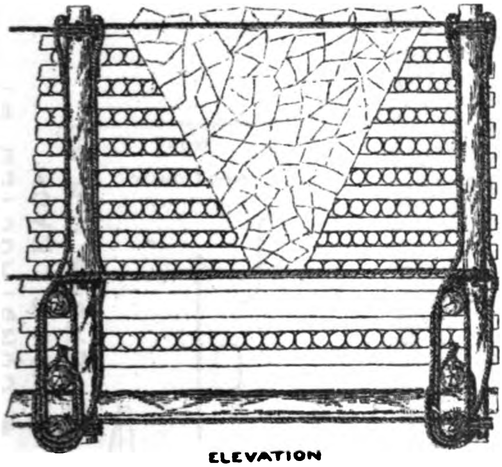
SPUR DIKE REVETMENT
DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGRS. U.S.A.



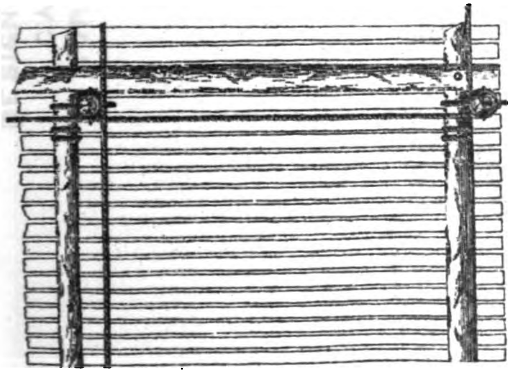
LONGITUDINAL SECTION OF CRIB

CITIZENS BLUFF PROTECTION FUND
OF
MEMPHIS, TENN.

SPUR DIKE REVETMENT
DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGRS. U.S.A.A.

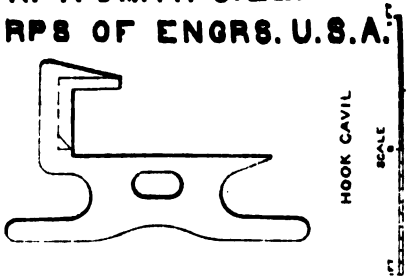


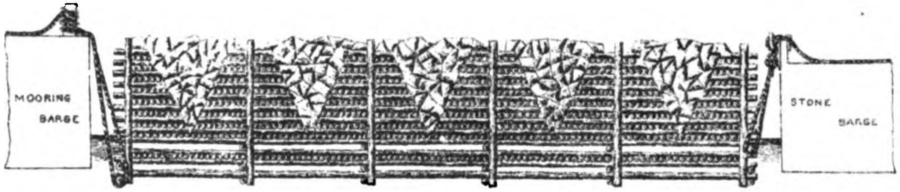
ELEVATION



CITIZENS BLUFF PROTECTION FUND
OF
MEMPHIS, TENN.

SPUR DIKE REVETMENT
DESIGNED & CONSTRUCTED BY
CAPT. SMITH S. LEACH
CORPS OF ENGRS. U.S.A.





CROSS SECTION OF CRIB
SHOWING METHOD OF FASTENING LINES TO CRIB AND BARGES

Statement of expenses for work done on Memphis Bluffs from July 1, 1886, to January 7, 1887.

Items.	Administration.	Care of plant and materials.	General repairs.		Tow-boats and tugs.		Pile-driving.		Revetment.						
									Subaqueous mattress.		Bank mattress.		Grading.	Total revetment.	
	Cost.	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	Cost.	Amt.	Cost.
Labor	$1,059.93	$1,685.54		$688.46		$1,975.07		$269.03		$4,196.27		$2,239 58	$482.60		$6,918.45
Subsistence stores						597.06									
Brush ....cords									2,208.6	2,104.43	1,550	1,667.68		3,758.6	3,832.11
Poles ....do									465.5	632.17	145	189.70		610.5	821.87
Stone ....cu. yds									1,997.7	2,188.44	948	1,038.56		2,945.7	3,227.20
Spikes ....pounds															
Iron ....do			545	12.04					650	11.38				650	11.88
Lumber ....feet			4,319	73.67	222	5.95			6,884	94.28				6,684	94.28
Manilla rope ....pounds					140	16.79			4,154	465.32				4,154	465.82
Coal ....boxes			320	112.00	4,315	1,555.25	140	49.00							
Hire of tugs						327.50									
Piles ....feet							2,555	166.08							
Miscellaneous	64.73	40.73		106.45		62.08		17.70		110.78					110.78
Furnished by the United States.															
Brush ....cords															
Stone ....cu. yds											242	266.20		242	266.20
Wire ....pounds									18,500	740.00	6,704	208.16		25,204	1,008.16
Wire cables ....do									10,500	459.37				10,500	459.37
Spikes and nails ....do									4,000	104.00	2,700	81.00		6,700	185.00
Iron ....do									383	7.60				385	7.60
Totals	1,124.66	1,720.27		992.62		4,539.70		501.81		11,174.04		5,750.88	482.60		17,407.52
Percentage of cost	2.24	3.44		1.98		9.06		1.00		22.29		11.47	.96		34.72
Work done									3,524.5 squares		1,112 squares			1,000 linear feet. 4,636.5 squares.	
Cost per unit									$3.17 per square		$5.60 per square			$17.41 per linear ft. $3.76 per square.	

Statement of expenses for work done on Memphis Bluffs from July 1, 1886, to January 7, 1887—Continued.

Items.	Dikes.						Grand total.		Per-cent-age.
	Subaqueous cribs.		Shore cribs.		Total.				
	Amount.	Cost.	Amount.	Cost.	Amount.	Cost.	Amount.	Cost.	
Labor		$7,301.53		$2,858.08		$10,159.56		$22,756.04	45.35
Subsistence stores								597.06	1.15
Brush ... cords	3,360.7	3,293.48	546	535.08	3,906.7	3,828.56	7,665.3	7,760.67	15.28
Poles ... do	828.65	1,097.18	149	194.93	987.65	1,292.11	1,598.15	2,113.98	4.22
Stone ... cubic yards	3,274	3,587.54			3,274	3,587.54	6,219.7	6,814.54	13.60
Spikes ... pounds	3,000	83.00			3,000	83.00	3,000	83.00	.17
Iron ... do							1,195	23.42	.05
Lumber ... feet							11,225	173.90	.35
Manilla rope ... pounds							4,300	482.11	.96
Coal ... boxes							4,775	1,716.25	3.42
Hire of tugs								327.50	.66
Piles ... feet							2,555	166.08	.35
Miscellaneous		155.74				155.74		558.21	1.12
Furnished by the United States.									
Brush ... cords			96	104.64	96	104.64	96	104.64	.21
Stone ... cubic yards			1,220	1,342.00	1,220	1,342.00	1,462	1,608.20	3.21
Wire ... pounds	35,124	1,404.96	7,700	308.00	42,824	1,712 96	68,028	2,721.12	5.45
Wire cables ... do	25,675	1,123.28			25,675	1,123.28	36,175	1,582.65	3.16
Spikes and nails ... do	8,553	248.89	2,000	52.00	10,553	300.89	17,253	485.89	.97
Iron ... do	7,260	153.11			7,260	153.11	7,645	160.71	.32
Total		18,448.70		5,391.68		23,843.39		50,135.97	
Percentage of cost		36.80		10.76		47.56			100.00
Work done	848,120 cubic feet.		155,778 cubic feet.		1,003,898 cubic feet.				
Cost per unit	2.2 cents per cubic foot.		3.5 cents per cubic foot.		2.4 cents per cubic foot.				

SUMMARY.

$21,156.88

Item.	Designation.	Administration.	Care of plant and materials.		General repairs.		Tow-boat and tugs.		Subsequent mattress work.		Total.		Percentage of cost.	Repairs to steamer *Graham*.		Grand total.
			Am't.	Cost.	Am't.	Cost.	Am't.	Cost.	Am't.	Cost.	Am't.	Cost.	Cost.	Am't.	Cost.	Cost.
Labor		$2,801.40		$1,239.10		$687.76		$1,413.90		$8,878.03		$14,500.25	$41.05		$874.87	$15,375.12
Subsistence stores		13.20		52.52		31.32		282.78		400.33		783.15	2.22			783.15
Brush	Cords								5,054.5	5,620.04	5,054.5	5,620.04	15.91			5,620.04
Poles	Cords								765	1,197.50	765	1,197.50	3.39			1,197.50
Stone	Cu. y'ds.								4,195	7,073.61	4,195	7,073.61	20.03			7,073.61
Wire	Pounds								38,498	1,539.92	38,498	1,539.92	4.36			1,539.92
Wire cables	Pounds								15,693	607.98	15,693	607.98	1.97			607.98
Spikes and nails	Pounds				200	5.00			7,700	207.45	7,900	212.45	.60	600	16.60	229.05
Iron	Pounds				201	4.52	107	2.41	5,477	148.01	5,785	154.94	.43			154.94
Lumber	Feet				3,367	92.98			9,044	150.78	12,411	243.76	.69	8,334	202.03	445.79
Manila rope	Pounds				56	6.27			2,360	264.50	2,416	270.77	.77			270.77
Coal	Boxes		58	29.20	75	30.00	4,582	1,597.30	200	75.00	4,915	1,731.50	4.90			1,731.50
Hire of tugs								168.00				168.00	.47			168.00
Rent		401.88										401.88	1.16			401.88
Advertising and stationery		83.23										83.23	.23			83.23
Furniture		225.60										225.60	.64			225.60
Miscellaneous		70.22		20.71		53.64		158.65		113.60		416.82	1.18		342.18	758.95
Totals		3,595.53		1,341.59		914.49		3,623.04		25,846.75		35,321.40	100.00		1,435.63	36,757.03
Percentage of cost		10.17		3.80		2.57		10.26		73.20						

Work done	7,836.30 squares. 2,950 linear feet of bank protection.	Cost per unit	$4.52 per square. 11.97 per linear foot.

SMITH S. LEACH,
Captain of Engineers.

Appropriation for improving Mississippi River, Second District.

FINANCIAL STATEMENT.

Balance on hand June 30, 1887, as per last report		$91,95
Amounts received since, viz:		
Reallotted by Mississippi River Commission:		
Levees, White River Front	$75,000.00	
Robinsonville Levee, Yazoo Front	60,000.00	
		135,00
Total		226,95
Expended from July 1 to October 31, 1887:		
On account Memphis Harbor	$13,890.96	
On account Memphis Reach	4,854.05	
On account Memphis Harbor and Reach	304.22	
On account levees, Yazoo-Mississippi Delta levee district	.50	
On account levees, White River Front	1,995.61	
		21,04
Balance October 31, 1887		205,91

General balance sheet.

MEMPHIS HARBOR.

DR.					C
1887. June 30	To balance	$31,012.41	1887. Oct. 31	By amount expended from July 1, 1887, to date By balance	$13, 17,
		31,012.41			31,

MEMPHIS REACH.

1887. June 30	To balance	$60,000.00	1887. Oct. 31 Oct. 31	By amount expended from July 1, 1887, to date By balance	$4, 55,
		60,000.00			60,

MEMPHIS HARBOR AND REACH.

1887. June 30	To balance	$864.56	1887. Oct. 31 Oct. 31	By amount expended from July 1, 1887, to date By balance	$
		864.56			

LEVEES, YAZOO-MISSISSIPPI DELTA LEVEE DISTRICT, UPPER YAZOO.

1887. June 30	To balance	$82.00	1887. Oct. 31 Oct. 31	By amount expended from July 1, 1887, to date By balance	
		82.00			

ROBINSONVILLE LEVEE, YAZOO FRONT.

1887. July 2	To amount allotted by Mississippi River Commission	$60,000.00	1887. Oct. 31	By balance	$60,

General balance sheet.—Continued.

LEVEES, WHITE RIVER FRONT.

887. uly 2	To amount allotted by Mississippi River Commission.	$75,000.00	1887. Oct. 31	By amount expended from July 1, 1887, to date…… By balance……………	$1,995.61 73,004.39
		75,000.00			75,000.00

SECOND DISTRICT.

bursements made under appropriation for improving Mississippi River, act of August 5, 1886.

[November 1, 1886, to November 1, 1887.]

Contracts made with—	For what made.	Disbursements under contract.	Liabilities under contract.	Total.
R. Brickey…………	Brush and poles.	$2,941.41	…………	$2,941.41
Kee, McLaws & Co…………	Levee work……	53,176.58	…………	53,176.58
el T. Hartnett…………	……do……	16,253.04	…………	16,253.04
Arnold & Co…………	……do……	11,838.24	…………	11,838.24
J. Cooney…………	……do……	12,415.75	…………	12,415.75
W. Hunter & Co…………	Brush and poles.	1,883.70	$4,416.30	6,300.00
es & Stockley…………	……do……	1,749.48	4,840.52	6,590.00
iel T. Hartnett…………	Levee work……	…………	73,000.00	73,000.00
J. Cooney…………	……do……	…………		
T. Jefferson…………	……do……	…………		
		100,258.20	82,256.82	182,515.02

Disbursements otherwise than under contract.

For what expended.	By public notice and sealed proposals.	In open market.	Liabilities.	Total.
erial and supplies…………	$4,766.42	$8,072.76	$6,649.89	$19,489.07
sistence supplies…………	1,818.21	846.35	1,084.05	3,748.61
rvices…………	…………	27,139.62	5,417.80	32,557.42
scellaneous…………	…………	2,241.13	146.93	2,388.06
	6,584.63	38,299.86	13,298.67	58,183.16

SMITH S. LEACH,
Captain of Engineers.

U U 2.

ANNUAL REPORT FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

THE MISSISSIPPI RIVER COMMISSION,
PRESIDENT'S OFFICE,
New York, September 21, 1888.

SIR: The Mississippi River Commission has the honor to submit a port for the fiscal year ending June 30, 1888, embracing the following bjects:

1. Surveys and examinations.
2. Construction.
3. Financial statements.
4. Estimates.

SURVEYS AND EXAMINATIONS.

This work was in charge of Capt. S. S. Leach, Corps of Engine
until March 17, 1885, when he was relieved by First Lieut. J. L. Lu
Corps of Engineers, who was himself relieved by Capt. C. F. Pow
Corps of Engineers, May 31, 1888.

As stated in the last Annual Report, the survey of the Mississip
River below Cairo is completed, so far as the field work is concern
while the preparation of the maps for publication is still to be finish
and the surveys on the Upper Mississippi have been only partial
executed.

During the past year no field work has been done, and the off
work, conducted on a limited scale up to December 31, 1887, has be
practically suspended since that time for want of funds.

For details see report of Lieutenant Lusk, secretary of the Comm
mission, Appendix B.

CONSTRUCTION.

General service.

This work was in charge of First Lieut. J. L. Lusk, Corps of En
neers, until May 31, 1888, when he was relieved by Capt. C. F. Pow
Corps of Engineers.

The survey fleet and part of the general-service fleet have been l
up at Chester, Ill., where such repairs as were needed have been ma

The supply of stone to the works at Memphis and Greenville w
attended with a complication of difficulties. The laws relating to t
use of convict labor made it impossible to obtain it from the penit
tiary authorities at Chester; the low stage of the Ohio cut off the qu
ries on that river; and the protracted low water on the Mississip
with the dense smoke from forest fires, made navigation very slow a
hazardous. The loss from accident was, however, trifling.

For details and financial statement see report of Lieutenant Lu
Appendix D.

First district.

(Cairo to foot of Island No. 40, 220 miles. Officer in charge, Capt. S. S. Leach, C
of Engineers, to March 25, 1888; after that date, Capt. W. T. Rossell, Corps of E
neers, Memphis, Tenn.)

No work of channel construction has been done during the year,
consequence of the prohibitions of Congress as to revetment.
November, 1887, a request was made by the citizens of Hickman, K
that the specific appropriation of $18,750 for that point might be
pended in protecting their river front; but upon examination and
port by the engineer officer in charge it appeared that there was
reason for departing from the resolution adopted by the Commissio
their meeting in September, 1886.

The works on Plum Point Reach have suffered but slight damage f
river action; and this has been confined to unguarded parts of the
vetment in Fletcher's Bend, which has held out better than, in its un
ished condition, was expected. In the dry weather of November, 1
fire from the forests was communicated to Osceola cross-dike N
and 800 feet of it was destroyed.

The deposits behind the Plum Point dikes, and, to some extent
the chutes and secondary channels on the reach, have increased in de
and area; and the restriction of the low-water channel has continue

aintain good navigation. The least depth found during a season of usually low water was 8.5 feet, and this only for a day or two, and pending on a single observation, admitting of some uncertainty; aside n this the least depth found was 9 feet.

The necessity of holding the bank line is growing evident. Caving Ashport Bend indicates that protection will be needed there; the up-r end of the Fletcher's Bend revetment is endangered by the insta-ity of the bank above it; and caving below the Osceola revetment ssibly threatens to re-open Bullerton Chute.

Levees.—With the allotment of $75,000 for levees, Plum Point Reach, st bank, new levee has been built and old work enlarged for 22 miles m opposite Ashport to the Craighead Point Levee, closing, in con-ection with work done by private persons, a front of 30 miles, over ich, in the flood of 1882, the net escape was 35,000 cubic feet per ond.

For details see report of Captain Rossell, Appendix E.

Second district.

(Island No. 40 to mouth of White River, 180 miles. Officer in charge, Capt. S. S. ch, Corps of Engineers, to March 25, 1885; after that date Capt. W. T. Rossell, ps of Engineers, Memphis, Tenn.)

The channel work in this district has been for bank protection, con-ed to Memphis Harbor and Hopefield Bend, just above. During the r there has been added to the revetment in Hopefield Bend 4,000 ar feet of mattress, 335 feet wide; 105 linear feet of repair work has n done. The entire length of bank revetted is now 12,000 feet. e officer in charge estimates that an extension of 5,000 feet down-eam will be needed to secure Hopefield Point.

The revetment of Memphis City front down to Beale street and the izens' Bluff protection work below that point have been completed, gether forming a system 10,000 feet in length and perfectly protect-g the bank for the present. Caving in front of Fort Pickering, how-er, indicates that it will be necessary to extend the system about 00 feet farther down.

Levees.—*Yazoo Front.*—The allotment of $60,000 for Robinsonville vee has not yet been expended, awaiting the action of the Yazoo-ssissippi Delta Levee Board. The board has lately announced its diness to begin the work, and authority has been asked to make an reement with the State contractor for work to the extent of the allot-nt; the whole construction to be subject to the inspection and ap-val of the United States engineer officer in charge of the district.

White River Front.—In conjunction with the board of Cotton Belt vee District No. 1, the allotment of $75,000 has been expended on e extension of the levees below Helena, Ark., and a line 14½ miles g has been completed to a grade 2 feet above the high water of 86.

For details, see report of Captain Rossell, Appendix F, and report of erations of Mississippi River Commission, dated December 16, 1887, ppendix G.

Third District.

(Mouth of White River to Warrenton, 220 miles. Officer in charge, Capt. W. T. ell, Corps of Engineers, Memphis, Tenn.)

This district includes Lake Providence Reach and the harbors of enville and Vicksburg.

Lake Providence Reach.—No work has been done during the
The condition of the work is substantially as at the last annual re
the tops of the piles in all the systems giving way to decay and th
tack of drift. This does not sensibly affect the deposits in the cl
chutes; the depth of water in them remains stationary or continu
decrease, except at Mayersville, where the caving at the head of
island has flanked the dike. Here the chute has increased in dept

The revetments on Mayersville Island and at Pilcher's Point re
as at the last report, the small portions still in place having underg
no further loss.

The lowest water of the year was 1.5 feet on the Lake Provide
gauge November 22–24, at which time Stack Island Crossing,
shoalest on the reach, gave 9 feet depth. The least depth on this cr
ing, which has deteriorated since the suspension of operations, wa
feet, in September, at a higher stage, before the river had selected
low-water channel.

The banks of the reach have been more unstable than heretofore,
consequence apparently of changes in the regimen of the river abo
the total caving amounting to about 300 acres on each bank.

Greenville Harbor.—The attention of the Commission was invited,
1883, to the recession of the bank at Greenville, Miss., and in the A
nual Report for 1884 an estimate for the protection of this place was
troduced. In the act of August 5, 1886, a specific appropriation
$37,500 was made, but the Commission, considering this too small
successful application, did not feel justified in recommending its
penditure.

In July, 1887, the city of Greenville having engaged to supplem
the appropriation by at least on equal amount, a project was adop
which received the approval of the Secretary of War, and has si
been carried into effect. The system includes 10 sloping spurs of cr
work resting on mattress foundations and extending from the deep
water to high-water mark. These are situated about 500 feet ap
and by their action on the currents, shown by the filling which th
have already induced, have protected that part of the bank imme
ately endangered. In case the remaining part of Island 83, which li
just above the works, and has been subject to serious erosion, should
carried away before the strain upon it is relieved, the upper end of th
work just finished will be exposed to attack, and additional work w
be required to make it secure. Extension down-stream is also to
provided for. The cost of the work just completed is about $20 p
linear foot of bank protected.

Vicksburg Harbor.—The project for improvement by constructin
dikes and dredging a basin and canal to 5 feet below the zero of th
gauge, as stated in the last annual report, was recommended by the Con
mission July 1, 1887, and approved by the Secretary of War, with au
thority to begin the work with the specific appropriation of the act
August 5, 1886. In pursuance of the project a close dam has been bui
from the city to De Soto Island, 1,750 feet, and a screen dike 4,000 fe
in length, from the foot of De Soto Island to and along the canal. Th
canal has been dredged, for its full length of 5,150 feet, to 18 feet o
the gauge, with a width of 75 feet, which under the contract is to be i
creased to 100 feet.

The mean fill over the canal site during the year has been 1.2 fee
It is expected that after completion of the work this will be reduce
one-half, leaving less than 30,000 cubic yards to be removed by annu
dredging.

Delta Point.—No work has been done, but several slips in the bank ove the revetment show erosion there which will require extension of e revetment up-stream.

Levees—Tensas Front.—With an allotment of $56,500 for the levee m Amos Bayou to Arkansas City, and a later allotment of $155,083 r levees from Amos Bayou to the Louisiana State line, work has been rried on along the whole front. It had been decided by the Com-ission to build the line 3 feet above the highest water from Amos ayou to Lucca Landing; from there to Arkansas City 2½ feet, and the st 2 feet, except at lake crossings, where greater height would be ven. This work has been finished, with the exception of a portion low Lucca Landing, where caving is feared, and the Whiskey Chute ree, where extensive sinking has delayed completion.

The escape on this front, from Amos Bayou to the lower limit of the trict, opposite Warrenton, Miss., during the last high water, has een confined to a gap left in a part of the work done in the State of rkansas by the State of Louisiana, and a small break near Grand Lake; e levees, with these exceptions, being continuous. Considerable sink-g has occurred at Lake Chicot crossing, and more may be expected.

For details, see report of Captain Rossell, Appendix H.

Fourth District.

(Warrenton, Miss., to Head of Passes—484 miles. Officer in charge, Capt. D. C. ngman, Corps of Engineers, New Orleans, La.)

Harbor of New Orleans.—In Gouldsboro Bend one new spur has been nstructed and two others raised to grade, completing the system of x spurs, as projected. Examination shows that the construction has otected the bank; it can not be discovered, however, that any deposit tween the spurs has been induced.

Rectification of Red and Atchafalaya rivers.—The location fixed upon r the first of the projected system of six submerged dams in the Atch-alaya is about 500 feet below the Bayou des Glaizes. The mattress l for this dam has been laid during the year, and connected with the rees on each side by earthen dikes sodded or (if below ordinary high ater) paved with stone.

For the maintenance of a navigable channel in lower Old River, $15,000 s allotted. This was expended during the low-water season in an effectual attempt to keep the channel open by the methods heretofore ed. The failure was due to the same causes as in the preceding year, z, the forcing up of the bottom by the weight of the banks, as the river ll, and the absence of scouring force due to the simultaneous decline f both rivers, with feeble currents in alternating directions. Naviga-on was closed from the beginning of August to the middle of Decem-r.

Levees.—With allotments amounting to $165,000, the Deer Park levee s been built, and up to May 30 about one-half of the new Kempe vee. The State and district authorities have undertaken the closure f Diamond Island gap by a levee nearly 7 miles long, of which about o-thirds has been completed. Repairs have also been made to the vee at Shipp's Bayou and to Glasscock's levee, which had been again maged by beavers.

When work now in progress is completed the only gaps in levees in is district will be Bougère Crevasse, 23,400 feet long, and from Black awk to Red River, about 90,000 feet.

Surveys in Morganza Bend show an increase in area of the river sections both above and below the site of the crevasse since its closure.

For details and a discussion of the Atchafalaya problem, see rep of Captain Kingman, Appendix I.

REMARKS.

No appropriations for the expenses of the Mississippi River Commi sion have been made since July 7, 1884. The result has been that th Commission has been unable properly to perform its duties or to e amine the works for which it is reponsible. No inspection by the Co mission of the works along the river has been possible since Novembe 1885, on account of lack of funds.

The river and harbor act of August 5, 1886, limited the Commissio in the use of revetment to so great a degree as to make it unadvisabl to attempt much work on the Plum Point and Lake Providence reache with the funds it provided. The result of this limitation has been lo of work and increase in the final cost of improvement. The last wo of any importance on these reaches was with the funds provided by th river and harbor act of July 5, 1884; thus, during a long interval time, the works have been exposed to the attacks of the river, and fo all wood-work above water to great injury by decay. In the Plum Poi Reach, while some work has been lost, the injury as yet has not bee arge, but the works in the Lake Providence Reach are now in a very u latisfactory condition.

FINANCIAL STATEMENTS.

Appropriation for salaries and expenses Mississippi River Commission:	
Balance on hand July 1, 1887	$3, 501.
Expended from July 1, 1887, to June 30, 1888	3, 500.
Balance on hand July 1, 1888	0.
Appropriation for surveys of Mississippi River:	
Balance on hand July 1, 1887	10, 481.
Expended from July 1, 1887, to June 30, 1888	9, 597.
Balance on hand July 1, 1888	883.
Appropriation for improving Mississippi River:	
Balance on hand July 1, 1887	1, 402, 936.
Refunded on sundry accounts	
Total	1, 402, 937.
Expended from July 1, 1887, to June 30, 1888	965, 934.
Balance on hand July 1, 1888	437, 002.

ESTIMATE OF FUNDS FOR THE MISSISSIPPI RIVER COMMISSION FOR THE FISCAL YE ENDING JUNE 30, 1890.

Sundry civil bill.

Mississippi River Commission: For salaries, inspections, and traveling expenses of the Mississippi River Commission; for printing and telegraphing; for office expenses and miscellaneous	$35, 0

River and harbor bill.

For surveys and examinations of the Mississippi River from the Head of the Passes to its headwaters—continuing survey	$150, 0
For improving the Mississippi River from the Head of the Passes to the mouth of the Ohio River	4, 000, 0
For work at Columbus, Ky.—continuing improvement	25, 0

r work at Hickman, Ky.—continuing improvement	$181,750
r work at Greenville, Miss.—continuing improvement	230,000
r work at Vicksburg, Miss	125,000
r work at New Orleans, La	230,000
r rectification of Red and Atchafalaya rivers	300,000

C. B. COMSTOCK,
Lieut. Col. of Engineers,
Bvt. Brig. Gen.,
President Miss. R. Comm.
CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.
B. M. HARROD.
R. S. TAYLOR.
S. W. FERGUSON.
O. H. ERNST,
Major of Engineers.

The SECRETARY OF WAR,
(Through the Chief of Engineers.)

List of appendices accompanying the foregoing report.

APPENDIX A.—Second paper by General Comstock, on effect of overflow on velocity and flood height.
APPENDIX B.—Report of the secretary of the Commission.
  1. Elevations and descriptions of secondary triangulation stations, Cairo to Donaldsonville.
  2. Geographical positions of tertiary points, Keokuk to Cairo.
  3. High-water marks of 1888.
  4. Low-water gauge-readings, 1887-'88.
APPENDIX C.—Table of low-water soundings on bars, 1886-'87.
APPENDIX D.—Report of the secretary of the committee on construction.
APPENDIX E.—Report of Captain Rossell upon operations in the first district.
APPENDIX F.—Report of Captain Rossell upon operations in the second district.
APPENDIX G.—Report of Captain Leach upon operations in the first and second districts to November 1, 1887.
APPENDIX H.—Report of Captain Rossell upon operations in the third district.
  1. Report of Captain Rossell upon Vicksburg survey.
APPENDIX I.—Report of Captain Kingman upon operations in the fourth district.
  1. Improving harbor at New Orleans, La.
  2. Rectification of Red and Atchafalaya rivers.
  3. Construction and repair of levees.

List of plates accompanying the foregoing report.

Plum Point Reach—
  November, 1887, Appendix E.
  May, 1888, Appendix E.
  Changes in bank lines, Appendix E.
Memphis Reach and Harbor, Appendix F.
Hopefield Bend, Appendix F.
Greenville Harbor improvement, Appendix H.
Lake Providence Reach, Appendix H.
Vicksburg and Mississippi River survey, Appendix H.
Vicksburg Harbor, details of improvements, Appendix H.
Red and Atchafalaya projects—seven sheets—Appendix I.
Improvement of harbor at New Orleans, Goldsboro Bend.

NOTE.—In consequence of the resignation of Professor Henry Mitchell, there is a vacancy in the Commission.

APPENDIX A.

EFFECT OF OVERFLOW IN DIMINISHING VELOCITY OF MISSIS RIVER, AND EFFECT OF LEVEES ALONG YAZOO FRONT ON FL HEIGHTS IN 1882 AND 1883.

SECOND PAPER.

Paper presented by General C. B. Comstock at a meeting of the Commission on steamer Mississippi November 10, 1885.

1. In a paper dated March 15, 1884, addressed to the Mississippi River Commi and published in its annual report for 1885, I concluded: 1st, that the observa of the Commission give no support to the theory "that when flood escape ove Mississippi River banks begins the velocities in the main river are checked an posits induced; and the checking of velocity arises from this escape;" 2d, "the theory that levees built in 1882-'83 reduced the flood heights at Vicksb 1883 as compared with 1882 is not needed to account for the facts."

Under date of August 28, 1885, Maj. C. R. Suter submits to the president of Commission a paper prepared in accordance with Major Suter's instructions, di ing from those conclusions. As those conclusions were correct, the paper needs e ination.

The first conclusion will first be considered. The majority of the Mississippi Commission, in their report for 1883, say: "The loss of volume through high-w outlets causes both a diminution of velocity and a deflection of the thread of ment of the stream towards the outlet, accompanied by loss of the power necessar transport the material with which it is loaded."

If it is true that when overflow begins, the velocity in the river is diminishe the overflow accurate velocity observations in the main river at the time of escape should establish that fact. In my paper of March 15, 1884, I showed that Commission was then in possession of such observations at twelve points where o flow occurred, scattered from near Saint Paul to the Red River. At eleven of th points there is no decrease in the velocity of the main river, as it rises from the when overflow begins, to its maximum stage. At one, Hays' Landing, there slight decrease. At eight of the twelve stations the velocity steadily increases ing this period. At three others the velocity remains about the same during period. At two of these three, Grafton and Clayton, this constancy of velocity ing the overflow period seems to be accounted for by the local slopes. At the th Hannibal, there are not sufficient data for discussion; at one out of the twe namely, Hays' Landing, there are at times great irregularities in the velocit which are at least in part accounted for by the variation in slopes; but the velocit while the river was rising from its overflow stage, January 23, to its maximum heig March 20, were quite regular. From January 23 to February 27, the velocities var little from 5.9 feet. Between February 27 and March 20 ten velocities were mea ured. They are well represented by a right line giving for February 27, 1882, gau equal 37.52 feet, mean velocity equal 6 feet, and for March 20, 1882, gauge equ 38.59 feet, mean velocity equal 5.5 feet. Here is a case where the velocities dimin about 0.5 foot as the river rises towards its maximum. But in my judgment this crease of 8 per cent. in velocity is essentially accounted for by the fact that the f in the water-surface from Lake Providence to Hays' Landing was 4.05 feet on Fe ruary 27, 1882, and 3.28 feet on March 20, 1882, a decrease of 19 per cent., while fro Hays' Landing to Vicksburg, on the same dates, the falls were 12.98 feet and 9.87 fe a decrease of 24 per cent. These decreases above and below Hays' Landing indica a reduction in the slope between the two dates of about 21 per cent. at this pla which, by the ordinary velocity formula would account for a diminution in veloci of 10 per cent., or slightly more than the observed diminution. No new theory needed to account for the difference in velocity between the two dates, February 1882, and March 20, 1882.

2. It seems scarcely necessary to say to the Commission that slopes over long di tances are used because they are the only ones available for comparisons. While high stages the slopes on the river become much more uniform that at low river, y the changes in slope at a given station derived from stretches of the river above a below (the lower being 46 miles in length), must be regarded as giving only a ge eral indication of the changes going on in the local slope, which, however, is val able in the absence of more accurate information.

The paper submitted by Major Suter contains remarks on the Fulton slopes an discharges of 1884, and those between Arkansas City and Vicksburg in 1882 and 18 They add no information that affects my first conclusion. Every one knows that th upper part of a velocity curve is sometimes irregular. The important point is, do the velocities seriously decrease when the overflow stage is reached in consequence of the water escape over the banks, and does this checking of velocity cause deposits in the river below? If the checking of velocity without any change of slope to account for it, were a fact, it certainly ought to be shown at some one of our twelve discharge stations examined. As it is not, I can only repeat my first conclusion, namely, "that the observations of the Commission give no support to the theory that when flood escape over the Mississippi River banks begins the velocities in the main river are checked and deposits induced, and that the checking of velocity arises from this escape."

3. The second conclusion in my paper of March 15, 1884, is, that "the theory that levees built in 1882-'83 reduced the flood heights at Vicksburg in 1883 as compared with 1882, is not needed to account for the facts."

Major Suter, in his letter, dissents from this. In my paper of March 15, 1884, my conclusion was based merely on the relative stages of the Mississippi River at Helena; on those of the White and Arkansas rivers at or near the time of the maximum Vicksburg gauge-reading, and on the probably smaller return flow from the Yazoo swamp in 1883 than in 1882. As the gauges from Lake Providence to Helena at the maximum stage (48.8) at Vicksburg, March 20, 1882, were higher than at the Vicksburg maximum stage (43.8) April 7, 1883, by amounts that increased from feet at Vicksburg to 9 feet at Helena, this strongly indicated a smaller discharge in that part of the river in 1883. But in my paper no attempt was made to determine the precise discharges in 1883, as the data for such a determination are far from sufficient for exactness between Helena and Vicksburg. As the paper submitted by Major Suter attempts to determine such discharges and give a value for the discharge at Vicksburg in 1883 at the maximum gauge-reading which for the main river at Vicksburg is 7,000 cubic feet per second larger than the corresponding discharge in 1882 (the Yazoo swamp return flow in both years being excluded), it becomes necessary to make the best estimate possible of these discharges in 1882 and 1883 in order to show that my conclusions were correct and that the paper is not.

4. On March 20, 1882, the Vicksburg gauge reached its maximum for the year of 48.75 feet, and the discharge at Hays' Landing on that day was 937,000 cubic feet with a gauge-reading of 38.59 feet. On April 7, 1883, the Vicksburg gauge reached its maximum for that year of 43.80 feet, and the Lake Providence gauge read 33.20 feet. What was the discharge at Hays' Landing on that day? There was no gauge record at Hays' Landing, and the Hays' Landing gauge-reading must be computed from the Lake Providence reading. In 1882, at Lake Providence stage of 33.20, that gauge read on an average about 0.5 foot more than the Hay's Landing gauge, and 32.7 feet will accordingly be taken as the Hays' Landing gauge-reading, April 7, 1883. If the Hays' Landing discharge curve of 1882 gave in the vicinity of this gauge-reading but a single value for the discharge that value might be taken as an approximation to the discharge there on April 7, 1883. Unfortunately, in the vicinity of 33 feet it gives widely varying values for the discharge. It is known that slope, when mean depths vary little, exercises a powerful influence on velocity. Hence, in selecting from the discharge curve of 1882 a discharge which would most probably represent that of April 7, 1883, the dates in 1882 selected should have not only gauge-readings but also slopes as nearly equal as possible to those observed April 7, 1883.

The nearest gauges read in both years were those of Greenville, Lake Providence, and Vicksburg, hence these must be used in comparing slopes. (It is not probable that the average values of the slopes would be much different if Hays' Landing were to replace Lake Providence.) On April 7, 1883, the fall in the river surface from Greenville to Lake Providence was 19.13 feet, and from Lake Providence to Vicksburg was 12.98 feet.

Since the return flow from the Yazoo swamp produces most effect on slope where it enters the Mississippi, and the effect nearly disappears in going up-stream, there is reason to believe that while the Yazoo swamp return flow is controlling the fall between Lake Providence and Vicksburg, the local slope at Hays' Landing will depend much more closely on the average slope above than on that below. Therefore, since there was no time in 1882 when the two falls from Greenville to Lake Providence and from Lake Providence to Vicksburg were each equal to those falls on April 7, 1883, we must take the date in 1882 when the fall from Greenville to Lake Providence was most nearly equal to the same fall on April 7, 1883.

In 1882 the Greenville gauge record is missing from April 9 to April 22 inclusive, but as far as can be judged by the general form of the curve, and from a comparison of it with that of Arkansas City, the fall between Greenville and Lake Providence in the river surface, between February 1, 1882, and June 25, 1882, had no value less than 20.98 feet, which was reached on May 6, 1882. On that day the fall from Lake Providence to Vicksburg was 14.43 feet. From these data it is seen that at no time between February 1 and June 25, 1882, was the average slope between Greenville and Lake Providence as small as on April 7, 1883; that its minimum value in the overflow

period in 1882 was on May 6, 1882, when it was 9 per cent. greater than on Ap
1883; and that on May 6, 1882, the average slope between Lake Providence
Vicksburg was 10 per cent. greater than on April 7, 1883. Both stretches agre
indicating a less slope at Hays' Landing at the later than at the earlier date,
giving double weight to the first it would follow that the Hays' Landing slope w
per cent. less in 1883. May 6, 1882, the Lake Providence gauge read 32.85 feet,
it read 33.20 feet on April 7, 1883. There is no information to show that the ri
bed had changed between 1882 and 1883, so that we must depend on gauge-readi
and the slopes for the discharge at Hays' Landing on April 7, 1883. The gauge-re
ings are practically the same, the evidence adduced above is strong that the sl
was much less at the later date. The conclusion then follows that on April 7, 1
the discharge at Hays' Landing was less than on May 5 or 6, 1882, when it was
served as 790,000 cubic feet. This value will, however, be taken for the discharge
April 7, 1883.

5. Having found 937,000 and 790,000 cubic feet per second as values for the
charges at Hays' Landing at the times of the maximum floods at Vicksburg in 1
and 1883, those for the part of the river between Arkansas City and Cottonwoo
miles below Hays' Landing, where the return flow from the Yazoo swamp in 1882
gan to come back into the river, may now be compared. Since no measures were m
of the Yazoo return flow in either year, no reliable comparisons of discharges in
two years can be made between Cottonwood and Vicksburg, and the paper tends
confuse and mislead by neglecting this fact. March 20, 1882, the Hays' Landi
observed discharge was 937,000 cubic feet per second. There was no escape
tween Hays' Landing and Cottonwood. The Mississippi River Commission Rep
for 1884 gives no escape into the Yazoo swamp between Hays' Landing and Arkan
City and (pp. 81-2) an escape of 82,000 cubic feet into the Tensas swamp between
same points. This, added to 937,000, gives 1,019,000 for the discharge at Arkan
City on March 19, 1882. Adopting the probably too large value, 790,000 cubic fe
previously obtained as the discharge at Hays' Landing on April 7, 1883, since t
river from Hays' Landing to Arkansas City was below overflow stage, the sa
discharges may be assumed as approximations over the whole stretch.

Tabulating the results for dates of maximum flood at Vicksburg in 1882 and 188

	Date.	Gauge.	*Discharg*
		Feet.	
Arkansas City	Mar. 19, 1882	44.90	1,019,0
Do	Apr. 6, 1883	37.25	790,0
Lake Providence	Mar. 20, 1882	38.32	937,0
Do	Apr. 7, 1883	33.20	790,0
Cottonwood	Mar. 20, 1882	....	937,0
Do	Apr. 7, 1883	....	790,0

From this table it is seen that the return flow of the Yazoo swamp in 1882, at th
time of the maximum Vicksburg flood on March 20, was superposed at Cottonwoo
and below on the main river, which had a larger discharge than at the correspondin
maximum, April 7, 1883, by about 147,000 cubic feet.

The paper submitted by Major Suter gives the following table, in which the dis
charges for 1882 agree with those given in the preceding table, while for 1883 *the*
differ widely.

	Date.	Gauge.	Discharge
		Feet.	
Arkansas City	Mar. 19, 1882	44.80	1,012,00
Do	Apr. 5, 1883	37.10	964,00
Lake Providence	Mar. 20, 1882	38.30	937,00
Do	Apr. 6, 1883	33.05	964,00
Vicksburg	Mar. 21, 1882	48.75	668,00
Do	Apr. 7, 1883	43.80	905,00

The cause of the difference needs examination. It should be noted that the 668,00
and 905,000 cubic feet given in the last table as Vicksburg discharges are not *suc*
in fact, but are Vicksburg discharges minus Yazoo swamp return-flow, and henc
they give no idea of the relative Vicksburg discharges in the two years.

To get the discharge at White River on April 7, 1883, the paper takes the *Helen*
discharge for April 3, 1883, from the Helena discharge curve of 1882 as 740,000 cubi

t, and then to get the discharge at White River on April 4 adds 224,000 cubic feet, ded by a very uncertain method, when a simple and pretty reliable one might have been d. At White River the Mississippi was about 6 feet below overflow stage on April 1883, so that the White River swamp must haye been almost entirely drained. Ind, the Helena and Memphis guage curves show that the far larger St. Francis mp was almost entirely drained by April 8. Hence, to obtain the discharge just low White River on April 4, 1883, as there was no escape and the only inflow was t of White River without swamp return-flow, which had probably ceased, it is ly necessary to add the White River discharge for April 4. In the printed list of ily discharges this is given as 17,800 cubic feet, which added to 740,000 gives 758,000 bic feet. Instead of 17,800 the paper adds 224,000, and hence makes all the disarges for 1883, given in the last table, about 200,000 cubic feet too large.

It is not known how the flow of the White and Arkansas rivers was distributed at eir mouths. Their combined flow was but about 65,000 cubic feet at this date. If th rivers had discharged through White River mouth, but 65,000 cubic feet should n be added instead of 224,000 to give the discharge just below White River. On pril 1 and 2 the combined discharge of the two rivers was still less, and these were e discharges which reached their mouths on April 4.

This explains the chief difference between the two tables and shows the error in e one last given.

It may be noted that on April 4, 1883, the Arkansas River discharge given in the inted list is 47,000 cubic feet. If this be added to the 758,000 cubic feet discharge White River there results for the discharge at Arkansas City, April 5, 805,000 cubic t, which differs but slightly from that derived from Hays' Landing and given in first table as 790,000 cubic feet.

It is therefore seen that the method followed in the paper submitted by Major ter would, if correctly applied, prove that the discharges at the time of the Vicksrg maxima in 1882 were much greater than those of 1883 above where the Yazoo amp return-flow comes in.

6. An attempt will now be made to form an idea of the relation between the Yazoo wamp return-flows in the two years at the time of the greatest floods at Vicksburg, hough from lack of data nothing precise can be obtained.

As those greatest flood heights result from this return flow, the return flow must be a maximum at about the time of the maximum height. In the Mississippi River Commission Report, 1884, may be found values of the observed escape into the Yazoo swamp in 1882 and 1883. They are respectively 782,000 and 546,000 cubic feet per second. In 1883 the observations were made near the maximum stage of the river, but in 1882, over the part where the greatest escape occurred, they were made at a stage from 1 to 2.2 feet below the maximum stage. Although the length of the crevasses would increase between the maximum stage and observations ten days or more later, it is not probable that this increase would balance the decreased flow due to a fall in the river surface, and it is probable that the 1882 observed escape should be increased to give the maximum value. If the value were increased it would make the ratio of maximum return flow to maximum escape smaller than that given below. Take, however, the observed value, 782,000 cubic feet.

Humphreys and Abbot, in 1858, obtained a discharge curve for Vicksburg. In 1885, the Mississippi River Commission obtained a discharge curve at Warrenton, just below Vicksburg, for Vicksburg gauge readings varying from 4 to 41 feet. The ascending branches of the two curves agree remarkably well, and notwithstanding the occurrence of the Vicksburg cut-off between the two dates, this enables us at once to use Humphreys and Abbot's Vicksburg discharge curve to determine discharges now occurring.

On June 24, 1858, with Vicksburg gauge reading 48.2 feet (48.8 feet on our gauge), they observed a discharge of 1,244,000 cubic feet per second. As on March 20, 1882, our Vicksburg gauge read 48.75 feet, we may take 1,244,000 cubic feet as the discharge on that day. At this time the escape into the Tensas swamp between Hays' Landing and Vicksburg (M. R. C. Rep., 1884, p. 82) was 269,000 cubic feet, which, added to 1,244,000, gives a sum of 1,513,000 feet. Subtracting the observed Hays' Landing discharge (937,000) there remains 576,000 as the flow from the Yazoo swamp on March 20, 1882. This is about three-fourths of the observed escape into the Yazoo swamp. Had the escape into the Yazoo swamp in 1883 lasted as long as that of 1882, we might roughly assume that the maximum outflow would also be about three-fourths of the 546,000 escape (or 408,000). But in 1882 the river at Helena was above 41 feet, which is the escape stage, for 114 days, while in 1883 it was above that stage but 60 days, the floods being at Helena of about the same height in the 2 years. The shorter duration of the 1883 flood must have failed to have filled the Yazoo basin as full, and must have given a return flow that was much less than 408,000 cubic feet. It does not seem improbable that the maximum return flow did not exceed one-half the maximum escape, or 273,000 cubic feet. Let us estimate for this value the discharge at Vicksburg on April 7, 1883. At Hays' Landing it was

790,000; adding 273,000 for the Yazoo swamp return-flow, there results 1,063,000, 181,000 less than in 1882.

But there is a more reliable method. The ascending branch of Humphreys Abbot's discharge curve at Vicksburg for 1858 gives for 43.8 feet, the gauge-readin April 7, 1883, a discharge of 1,120,000 cubic feet per second, or 124,000 cubic feet than on March 20, 1882, a value not differing widely from 1,063,000 cubic feet p ously obtained.

It is seen, then, that whether the Vicksburg discharges at top of floods in 1882 1883 are determined from the 1858 discharge curve, or from the Hays' Landing charge curve with the inflow and outflow between Hays' Landing and Vicksb added, the results are practically the same, namely, that the Vicksburg disch was about 150,000 cubic feet less April 7, 1883, than on March 20, 1882.

Collecting the preceding results, we have the following table, giving the exce of discharge in 1882 over those in 1883, at and immediately prior to the top of floods at Vicksburg in the two years.

	1882.	1883.	Exce 188
Arkansas City	March 19	April 6	222,
Lake Providence	March 20	April 7	147,
Cottonwood	March 20	April 7	147,
Vicksburg	March 20	April 7	150,

There are, of course, considerable uncertainties in these values, for such uncerta ties are unavoidable with our scanty data. They are much more reliable than th in the paper, and they explain the observed facts without resorting to the improba and unproven assumption that the relation between gauge-readings and discha was widely different in 1883 from that in 1882, in consequence of the building levees.

7. From this discussion it is seen (1) that at the top of the flood at Vicksbu March 20, 1882, the Mississippi River, between Cottonwood, where the Yazoo swa return-flow began to enter it, and Arkansas City, was discharging much more wa than at the top of the flood about April 7, 1883; (2) that the return flow from t Yazoo swamp was greater in 1882; (3) that the flow past Vicksburg was greater 1882.

I therefore repeat the second conclusion in my paper of March 15, 1884, viz, th "the theory that levees built in 1882–'83 reduced the flood heights at Vicksburg 1883, as compared with 1882, is not needed to account for the facts."

8. The paper submitted by Major Suter makes an estimate of the difference of di charges at points between White River and Vicksburg both inclusive at dates (a lowing three days for flow from White River to Vicksburg) immediately followi those of the Helena maximum gauge-readings of March 9, 1882, and of March 8, 188

The conclusions drawn are, that in the two years at these dates, at White River th discharges were equal, the gauge being .3 foot lower in 1883.

It may be noted that the list of daily discharges prepared under Major Suter's di rection gives at the mouth of White River a discharge for the Mississippi on Marc 9, 1882, exceeding that on March 8, 1883, by 135,000 cubic feet, or differing by 135,00 cubic feet from the value here taken. At Arkansas City the discharge was 349,00 cubic feet greater in 1883; gauge .7 higher. At Lake Providence the discharge wa 378,000 cubic feet greater in 1883; gauge 1.2 lower. At Vicksburg the discharge wa 566,000 cubic feet greater in 1883; gauge 3.5 lower.

The Yazoo return flow is not included in either year.

Such results are astounding if reliable. Unfortunately, they only furnish one mor example of the ease with which figures and assumptions can be made to prove any thing.

It will be at once noticed if the assumption that equal gauge-readings give equa discharges had been made for Arkansas City instead of for the mouth of White River all these quantities would have been reduced by 349,000 cubic feet.

As Arkansas City is below White River and Arkansas River, and below the flows o their swamps, instead of being like the White River station near the rivers and in the midst of their swamp return flow, it would have been probably a safer place at which to make assumptions as to equality of discharge. But the fact that, as one point or the other is chosen for the assumption, the results are changed by 349,000 cubic feet, shows sufficiently how uncertain those results are. It can not be assumed in advance that the relation between gauge-readings and discharges at Arkansas City has been widely changed by the construction of levees in 1882–'83, since that change is the very thing which is to be proven.

Leaving these general considerations, some errors in computations in this paper uncertainties in results will be examined. The value 319,000 cubic feet given e escape into the Yazoo swamp between White River and Arkansas City will rrected to 294,000 cubic feet if escapes 18, 19, and 20 (M. R. C. Report 1884, pp.) are included as they should be. The paper takes 117,000 cubic feet as the s escape in 1882, between White River and Arkansas City. The Mississippi r Commission Report, 1884, pp. 78–80, gives an observed inflow from White River ypress Creek of 98,000 cubic feet, and an observed escape of 64,000 cubic feet k of Arkansas City, leaving a net inflow of 34,000 cubic feet, and differing from 00 cubic feet escape given in the paper by 151,000 cubic feet. If the estimated pe for the maximum stage (86,000) were used, it would only change the 34,000 net w to 12,000 cubic feet, leaving the value in table in error by 129,000 cubic feet rding to the observations of 1882. Taking the observed net inflow (34,000 cubic) from the 294,000 cubic feet found above, there remains 260,000 cubic feet for the escape in 1882 between White River and Arkansas City. The paper gives 466,000 ic feet.

he paper assumes an escape of 117,000 cubic feet into the Tensas swamp March 883, between White River and Arkansas City. But (M. R. C. Report, 1884, p. 93), escape was observed between Cypress Creek and Arkansas City at the maximum e, which was but .7 foot below that of 1882, as 22,000 cubic feet. The inflow of the nsas and its swamps was not measured, but must have much exceeded this, giv- a net inflow March 10, 1883, in place of the escape of 117,000 cubic feet taken in paper. In the absence of information assume that the net inflow between White r and Arkansas City was the same in 1882 and 1883. As there was no escape into Yazoo swamp here it follows that the escape on the stretch was 294,000 cubic feet er on March 11, 1882, than on March 10, 1883, in place of the 349,000 cubic feet n in the paper.

March 19, 1882, the observed net escape into the Yazoo swamp between Arkan- City and Lake Providence, or Hays' Landing, was nothing, and March 15, 1883 it ,700 cubic feet. For this distance the observed escape into the Tensas swamp was 0 March 20–30, 1882, and 107,000 March 13, 1883 (M. R. C. Report, 1884, pp. 81, 00.) Hence the observed net escape was 31,000 cubic feet greater in 1883 than in , and it gives an excess of observed escape in 1882 over 1883 between White River Hays' Landing of 263,000 in place of 378,000 given in the paper. In 1882 the re- flow from the Yazoo Swamp extended up to Cottonwood, which is but three below Hays' Landing. As this return flow amounted to several hundred thou- cubic feet per second, and as nothing is known of its distribution between Cot- wood and Vicksburg, nothing can be known of the net difference of escapes or harges during the floods of 1882 and 1883 between these points. At Cottonwood difference of escapes would be the same as at Hays' Landing, or 263,000 cubic feet, there are no inflow data for estimating the differences between this point and ksburg.

he paper, however, by omitting the inflow from the Yazoo swamp, and by includ- the escape into the Tensas swamps, between Hays' Landing and Vicksburg, ob- the purely illusory result of 566,000 cubic feet as the excess of escape at Vicks- g in 1882. The paper is written in so vague a way that it is difficult to be sure t it really means. It says the excess of discharge at Vicksburg in 1883 was 566,000 ic feet. This can not be true, for the Yazoo return flows are neglected in both , and they differed widely in 1882 and 1883. If the paper intended to compare e two years the river flow above where the Yazoo return flow comes in, it should have made the error of including 247,000 cubic feet escape into the Tensas swamp w Cottonwood in 1882. The estimated value 566,000 therefore represents no dif- ce of river flow which really existed and is purely illusory.

In fine, on the assumption that at White River the discharges were equal on March 1882, and March 9, 1883, it is seen that an excess of discharge in 1883 over that of results on dates one or two days later than those at White River; (1) of 294,000 Arkansas City in place of 349,000 given in the paper; (2) of 263,000 at Hays' nding, or Lake Providence, in place of 378,000; and (3) of 263,000 at Cottonwood, place of 566,000 at Vicksburg.

Thus far only errors of computation have been considered; defects and uncertain- s in methods also need examination. Notwithstanding much smaller differences discharge than those given in the paper have been found, yet the uncertainties in e methods are such that even these changed results have no value as proof of the y that for equal gauge-readings discharges were much larger in 1883 than in 1882.

In the paper (1) the assumption is that at the dates chosen, when the gauge-read- at White River differed by but .3 foot, the discharges were equal. Now, the e River gauge is in the immediate vicinity of two large tributaries and their p flow, which must give varying slopes; there is no discharge curve there, and n not be assumed, if we had one, that it would be more regular than those ob- ed at Helena and Lake Providence, where, during the overflow stage at nearly equal gauge-readings, differences of discharge of about 300,000 cubic feet occur. Helena, March 13, 1882, gauge 46.5, the observed discharge was 1,562,000 cubic At Helena, March 29, 1882, gauge 44.6, the observed discharge was 1,259,000 feet, the river being in a falling stage on both dates, while on March 2, 18 gauge-reading was 1 foot lower than March 13, and the discharge was 320,000 feet less. Errors of 200,000 cubic feet or more are then possible in the assumpti equal discharges at White River on March 10, 1882, and March 9, 1883.

(2) The assumption that escapes into the Yazoo swamp for different dates an ferent gauge-readings are the same as at the dates on which they were observ liable to give large errors. The widths of crevasses change, and even with the river stage escape velocities may change as the country back of the levee fi Between White River and Vicksburg errors of 100,000 cubic feet or more may b troduced in these ways into estimates of relative escapes in the two years an errors of observation. Our knowledge of the net escape or inflow between W River and Arkansas City in 1882, 1883, and 1884, also is very small. In 1882 inflow of 34,000 cubic feet was observed at a stage 3 feet below the maximum w was at Arkansas City 47.1 feet. In 1883 the inflow above Cypress Creek was n served; the escape from there to Arkansas City observed was 22,000 cubic feet Arkansas City gauge reading 46.3 feet; in 1884 the observed escape into the Y swamp between Cypress Creek and Arkansas City was 211,000 cubic feet for g equal 46.4 feet, while the inflow between Cypress Creek and White River wa observed. In 1882, the estimated escape at maximum stage back of Arkansas was 86,000 cubic feet. So far as the observations in 1882 and 1883 go they ind in both years a net inflow on the west bank between White River and Arkansas that the paper submitted by Major Suter estimates on the contrary an outfl 117,000 cubic feet per second in both 1882 and 1883 (while containing an error of putation in not including the inflow in 1884 between Cypress Creek and White R is simply evidence of our ignorance of the true values. Under this head there be an uncertainty of 100,000 cubic feet.

It appears, then, that the values 294,000, 263,000, and 263,000 previously obtain the method of the paper for excesses of discharge about March 10, 1883, over March 11, 1882, are subject to one possible error of 200,000 cubic feet each, and t of 100,000 cubic feet each, these values being rough approximations. Hence the certainties in these values for the differences of discharges for the two years equal the values themselves, and therefore no safe conclusions can be based on values, even after they have been largely reduced by corrections.

10. Having shown that the methods followed in the paper to obtain the differe of discharge in the two years at dates immediately following the Helena maxim those years are subject to errors too great to give any value as proof to the result different method will be applied to estimate those differences.

Humphreys and Abbot's discharge curve for 1858, as already stated, is stro corroborated by the Warrenton discharge curve of 1885. The 1858 curve then be safely used for present discharges. On March 13, 1882, the Vicksburg ga read 46.5 or 45.9 on Humphreys Abbot's gauge. From the 1858 discharge curve corresponding discharge is 1,150,000 cubic feet per second, while in the same 1,100,000 cubic feet result for a gauge-reading of 42.4 on March 12, 1883. On Ma 12, 1882, the Hays' Landing discharge may be taken as 982,000 cubic feet, the obse tions giving a discharge of 982,000 cubic feet for a gauge-reading of 37.64 feet March 13, 1882. What was the discharge March 11, 1883, when the Hays' Land gauge (derived from Lake Providence) read 36.0 feet? The Hays' Landing discha in 1882 give for gauge-readings near this value: February 2, 1882, gauge equal 3 discharge equal 942,000 cubic feet; March 29, 1882, gauge equal 36.06, discharge e 915,000 cubic feet.

What value shall be taken as the discharge March 11, 1883? As in a preced case a discharge in 1882 should be selected for which slopes are nearly equal as as gauge-readings, to those of March 11, 1883:

	Fall, Greenville to Lake Providence.	Fall, Lake Providence to Vicksburg.	Discha
	Feet.	*Feet.*	*Cubic f*
March 11, 1883	22.31	17.05	....
February 2, 1882	21.56	16.93	94
March 29, 1882	22.68	12.55	91

From this table it is seen that February 2, 1882, the slopes above and be Hays' Landing agreed on the whole more nearly with those of March 11, 1883, t did those of March 29, 1882, and hence that the discharge of February 2, 1882, pro

y was nearer to that of March 11, 1883, than was that of March 29, 1882. On Feb-
ry 2, 1882, the fall from Lake Providence to Vicksburg was practically the same
a March 11, 1883, while from Greenville to Lake Providence the fall was 3 per
t. greater March 11, 1883. This indicates a slightly greater slope and discharge at
ys' Landing on the latter than on the former date when the discharge was 942,000
ic feet. We may take, then, 950,000 cubic feet as the Hays' Landing discharge on
rch 11, 1883. These figures make the Vicksburg discharge greater than at Hays'
ding in 1882 by 168,000 cubic feet and in 1883 by 150,000. The escape between
ys' Landing and Delta was observed as 269,000 in 1882, the Vicksburg gauge
ding 48.75, and as 59,000 March 14, 1883, the Vicksburg gauge reading 43.10.
Since the escape in 1882 was observed at a stage 2.7 feet higher than that of March
1882, the 269,000 cubic feet observed should be reduced. Call it 200,000 cubic feet.
1883 the observation stage differed little from that on March 12, 1883, and the ob-
rved escape, 59,000 cubic feet may be taken. Adding in each year the excess of
ksburg discharges to the escapes into the Tensas swamp the sums should be the
oo swamp return flow. Its value results as 368,000 cubic feet on March 13, 1882,
as 209,000 cubic feet March 12, 1883.

Going now from Hays' Landing towards Arkansas City the discharge there will be
d in each year by adding to the Hays' Landing discharge (982,000 or 950,000 given
ady) the escape above. There results 982,000 + 83,000 = 1,065,000 for the Arkansas
y discharge March 11, 1882, the gauge reading 45.5 feet, and 950,000 + 114,000 =
4,000 for the same discharge March 10, 1883, the gauge reading 46.2 feet.

The next step is to pass from the Arkansas City discharges to those at Helena. The
t uncertainties in the inflow from the west bank between Helena and Arkansas City
e already been referred to. March 28, 1882, the net observed inflow between He-
a and Cypress Creek (Mississippi River Commission Report, 1884, page 78), which
rently includes only water flowing in water-ways, was 187,000 cubic feet per
d. On March 9, 1882, both the White and Arkansas rivers were higher and the
ow may have been greater. Take it as 187,000. The estimated net escape into the
sas Bottom at maximum stage March 9, 1882, was 86,000 cubic feet, though a part
this probably came from the Arkansas. Take the difference between the two or
,000 cubic feet, as the net flow into the river from the west bank, between Helena
Arkansas City, March 9, 1882.

arch 12, 1883 (Mississippi River Commission Report, 1884, page 99), an escape of
000 cubic feet was observed between Cypress Creek and Arkansas City. Assume
to be the same March 8, 1883.

The net inflow between Helena and Cypress Creek was not observed, but the printed
of daily discharges gives, March 8, 1883, for the discharge of the White and Arkan-
, 100,000 cubic feet. This leaves a net inflow (nothing being known of the swamp
rn flow) of 100,000 — 22,000 = 78,000 cubic feet.

The observed escape into the Yazoo Swamp between Helena and Arkansas City,
rch 18, 1882, was 493,000 cubic feet, and on March 10, 1883, was 248,000 cubic feet
issippi River Commission Report, 1884, pp. 58, 97).

	Cubic feet.
ecting Arkansas City discharge, March 11, 1882	+1,065,000
ape into Yazoo Bottom, Arkansas City to Helena, March 18, 1882	+ 493,000
ow, west bank, Arkansas City to Helena	− 101,000
ena discharge, March 9, 1882	1,457,000
kansas City discharge, March 10, 1883	+1,064,000
oo escape, March 11, 1883, Helena to Arkansas City	+ 248,000
ow, west bank, March 8-12, 1883, Helena to Arkansas City	− 78,000
ena discharge, March 8, 1883	1,234,000

These results are subject to large uncertainties, for reasons which have already
en stated. But such as they are, starting at Hays' Landing with discharges given
the discharge curve there, on reaching Helena they give discharges for the two
ars and for nearly equal gauge-readings that are little more discrepant than actual
charge measurements a few days apart made in 1882 on a falling river, viz:
rch 13, 1882, Helena gauge, 46.5; discharge, 1,562,000 cubic feet; March 29, 1882,
ena gauge, 44.7; discharge, 1,259,000 cubic feet; the gauge differing but 1.8 feet.

Tabulating and adding for comparison the difference of discharges given in paper, there results:

Locality.	1882.			1883.				
	Date.	Gauge.	Discharge.	Date.	Gauge.	Discharge.	Discharge 1882 minus 1883.	Disch dif ence in 1882
Helena	Mar. 9	47.2	1,457,000	Mar. 8	46.9	1,234,000	+223,000	00
Arkansas City	Mar. 11	45.4	1,065,000	Mar. 10	46.2	1,064,000	+ 1,000	—34
Hays' Landing	Mar. 12	37.5	982,000	Mar. 11	36	950,000	+ 32,000	—37
Vicksburg	Mar. 13	46.5	1,150,000	Mar. 12	43	1,100,000	+ 50,000	—56

It should be noted that the 566,000 in the last column, while called differenc discharge in the paper submitted by Major Suter, is not so in fact.

A comparison of the last two columns in the table will show how widely the sults in the paper submitted by Major Suter differ from those obtained by a reliable process.

The paper seems not entirely consistent, for it uses the Hays' Landing disch curve of 1882 to verify the computed discharge there of 964,000 cubic feet on Ap 1883, the gauge reading 33.05, while in the preceding table on March 11, 1883, gauge reading 36, it supposes that the 1882 discharge curve was in error by a 378,000 cubic feet.

From the preceding discussion it is seen that the very natural assumption that relation between gauge-readings and discharges at Helena, Hays' Landing, Vicksburg (all points where we have discharge curves) was essentially the sam 1883 as in 1882, gives, in connection with the observed data as to inflow and esca those years, a series of discharges on the specified dates between Vicksburg and ena consistent with each other and with the data. Starting from Hays' Lan with a discharge which in 1882 was observed and in 1883 is probably not in erro 50,000 cubic feet, and transferring the discharges up-stream, an operation of great certainty, values of the discharges at Helena in the two years' result which d from each other less than the actual discharges observed at Helena differed at ne equal gauge-readings in 1882.

While, as already said, there are great uncertainties in any transfer of discha during the overflow period over so great a distance as from Lake Providence to ena, the fact that the observed phenomena are as well accounted for on the supp tion that equal gauge-readings gave approximately equal discharges in 1882 and between Helena and Vicksburg, as by the extraordinary theory that Vicksburg Lake Providence gauge-readings, smaller in 1883 than in 1882, gave very much la discharges, renders the latter theory untenable. Proof of it at present is enti wanting.

11. The paper submitted by Major Suter discusses the connection between s and velocity. While in one place it admits that slope "plays its part," yet the of the discussion is devoted to the attempt to belittle the influence of slope on veloc and it proposes to replace or supplement "slope," in discussing velocities, by complex and directly unmeasurable thing called "resistance to flow."

With the well-known defects in all velocity formulæ and the great irregulari in velocity and discharge curves the Commission is familiar, and can not expec yet to explain all these irregularities. But as gravity is the cause of any increas velocity of water, and as the work of gravity on unit mass of water, in moving unit length, is proportional to the slope, it will greatly astonish those familiar hydrodynamics to be told or to have it implied that slope is not one of the control elements in changes of velocity.

When this "resistance to flow" can be directly measured and expressed nu ically it may be inserted in velocity formulæ and used in velocity discussions. T far on the Mississippi it has not been so measured and expressed. It would be s until this resistance has been directly measured, to seek the causes of variation velocity first in changes in depths and slopes, which are approximately measura and then to study the residuals to find, if possible, causes for them.

No one familiar with the elements of hydrodynamics can doubt the importanc the slope in any attempt to explain the great irregularities in velocities, for ne equal gauge-readings, at our discharge stations.

The real difficulty is in measuring the slopes and in the inaccuracy of velo formulæ. What we need is the slope down the thread of water of greatest veloc

What we measure is the slope along shore, where great errors may be produced, when the gauge stations are near each other, by purely local irregularities in velocity nd by local variations in centrifugal force. We shall probably have to content urselves with average slopes over distances so great (say from 5 or 10 miles above he discharge station to 5 or 10 miles below) that local irregularities, amounting to 2 foot in the fall between the two stations, will not affect the value of the average lope by more than 5 per cent. Such average slopes would probably give a good approximation to the slope at the discharge station during medium and high stages. f the dimensions of the river cross-section between the extreme stations were very variable, they would have to be nearer at lower stages.

The paper implies that at Hays' Landing, in 1882, there were changes in slope without corresponding changes in velocity, especially when the return flow from the Yazoo Swamp came into the river. Even if we had perfect measures of the slopes at ays' Landing no one supposes that all the irregularities in the velocity and discharge curves could be explained, since our best velocity formulæ are only approximate and there are errors in the measurements. The best notions as to slope at Hays' anding on a given date can be got by examining the slopes from Hays' Landing up Lake Providence and down to Vicksburg, and by giving to the upper stretch, during overflow, double weight, since the Yazoo return flow would affect the average ope from Hays' Landing to Vicksburg much more than it would affect the local slope Hays' Landing. Unfortunately, the paper considers only the slopes between Hays' nding and Vicksburg, and takes these as the Hays' Landing slopes, thus in some es committing large errors. Special attention is given in the paper to the slopes Hays' Landing during overflow, and it is stated that "the great reduction of slope hen the Yazoo flood wave came into the river did not sensibly affect the variation velocity at Hays' Landing." The facts are these: Assuming the changes of slope Hays' Landing to be obtained by giving double weight to the changes in slope between Hays' Landing and Lake Providence and single weight to the change between ays' Landing and Vicksburg, and smoothing the velocity curve between February and March 20, 1882, the slope at Hays' Landing decreased 21 per cent. and the velocity decreased 6 per cent.; on March 21 large breaks occurred a little below Hays' nding, producing a local fall in the river of about 2 feet; March 20 to 22 the slope tween Hays' Landing and Lake Providence increased 15 per cent., and between ays' Landing and Vicksburg decreased 7 per cent., thus giving a computed increase slope of 7 per cent. at Hays' Landing and an increase of velocity of 2 per cent. The per apparently overlooks this break in levees and its effect on local slope, which to stop at Hays' Landing the decrease that had been going on below, and to give arly constant velocities for some time after. This break in the Alsatia levees, only 8 iles below Hays' Landing, makes any estimate of slope at Hays' Landing very uncertain, not only when it occurred, but also until the river was again within its banks, out April 20.

From April 26 to May 5 the computed slope at Hays' Landing decreased by 5 per t. and the velocities by 6 per cent.; from May 5 to June 2 the slopes increased by per cent. and the velocities by 20 per cent. These cases, which only include the ger changes in slope, while the gauge readings were nearly the same, are sufficient show the necessity of giving the slopes their proper weight in any attempt to explain velocities and discharges, and while at Hays' Landing the best values of the opes that we have still leave anomalies to be accounted for, the velocities clearly w the dependence on slope.

12. The paper compares the discharges at high stages at Fulton in 1880 with those 1884 at certain dates when the fall in the water surface from Fulton to Memphis as nearly equal, assumes that the discharge was the same from Fulton to Memphis, d concludes that sometimes the greater slope attended the smaller velocity. Possibly it may have done so in some peculiar cases; but as the data in Appendix C are ken mainly during the overflow period and this overflow is neglected and unknown, ere is doubt as to the conclusions. The Fulton observed discharges in 1884 show egularities at nearly the same gauge-reading of 200,000 cubic feet, and similar irregularities might be expected in different years. If, however, falls and discharges each of the groups given for 1880 be compared, it will be seen that in each case here the fall decreased by 1 or 2 feet the Fulton gauge changing little, there was a responding marked decrease in the discharge, showing what the paper apparently is seeking to controvert, namely, the influence, other things being equal, of pes on velocities and discharges.

13. The paper also states that it "upsets the idea that the diminished velocities at ys' Landing were due to the influence of backwater from the Yazoo." The facts that on March 8, 1882, the river at Arkansas City, Lake Providence, and stations ve was steadily falling. Above Lake Providence the fall continued till March 20, date of the maximum Yazoo-swamp return flow at Vicksburg. From March 8 to ch 20 the river rose at Lake Providence, and the cause of this rise was the backing up produced by the Yazoo return flow. How this rise at Lake Providence could

occur, the river above being still falling, without a checking in some degree of discharge and velocity at Lake Providence as a consequence of the return flow, I unable to understand.

Notwithstanding the inaccuracies in computation, as well as in methods, wh this paper presents, it has seemed necessary to notice it, lest its statements shoul accepted as correct. This seemed the more important, as Mr. B. M. Harrod, in American Engineer of May 29, 1885, had given estimates of the excess of dischar 1883 over 1882, which at Arkansas City and Lake Providence were still larger those in the paper submitted by Major Suter.

C. B. COMSTOCK,
Lieut. Col. of Eng'rs and Bvt. Brig. Ge

NEW YORK, *October* 21, 1885.
The MISSISSIPPI RIVER COMMISSION.

APPENDIX B.

REPORT OF LIEUTENANT JAMES L. LUSK, CORPS OF ENGINEERS, SECRETARY OF MISSISSIPPI RIVER COMMISSION.

OFFICE OF THE MISSISSIPPI RIVER COMMISSION,
2828 *Washington Avenue, Saint Louis, Mo., May* 31, 188

SIR: Complying with instructions contained in your letter of the 28th ultimo, have the honor to submit the following report of operations under the appropriati for "surveys of the Mississippi River" during the period beginning July 1, 1887, a ending May 31, 1888.

I relieved Capt. Smith S. Leach, Corps of Engineers, of his duties as secretary the Commission on March 17, 1888, and I expect to be relieved about May 31, 18 by my duly-appointed successor, Capt. Charles F. Powell, Corps of Engineers.

No field work whatever has been done since the beginning of the fiscal year.

Office-work was continued on a limited scale until December 31, 1887, when, owi to the low state of available funds, it was practically suspended. One assistant w retained to answer requests for data and information and attend to the current of the office.

In the clerical division, maps and reports were sent out as usual, and considera work was done in bringing records up to date.

In the topographical division, printed conventional signs were retouched on o detail chart, and conventional signs were drawn in by hand on four lake charts; tit notes, scales, and authorities were printed or drawn on about 150 detail cha These, with the unfinished charts above Cairo, comprising a total of 224 charts, w placed in storage-vaults for safe-keeping. This division also did some tracing a miscellaneous work.

In the computing division, the geographical positions of tertiary points located secondary triangulation from Keokuk, Iowa, to Fountain Bluff, Ill., were comput and tabulated, as were the elevations and slope of high-water marks for 1887, fr Cairo to Carrollton. The tabulation of gauge records at stations on the tributar of the Mississippi River was completed, and the tables were stereotyped. There w also revised and prepared for publication the elevations and descriptions of the ben marks to which the gauges at the stations in question are referred.

A large amount of work was also done in classifying and arranging maps and d for publication or for easy reference, in keeping up the current gauge records, and replying to inquiries from members of the Commission and the public.

A table of value of plant, financial statements, and a list of civilian engineers e ployed are herewith.

Very respectfully, your obedient servant,

JAS. L. LUSK,
First Lieut. of Engineers,
Secretary Mississippi River Commissio

Col. C. B. COMSTOCK,
Corps of Engineers, U. S. A.,
President Mississippi River Commission.

proximate value of plant belonging to the United States and used by the Mississippi River Commission in surveys and examinations of the Mississippi River.

Item.	Amount.	Item.	Amount.
steam-boat, *Patrol*	$10,000	Surveying instruments	$12,000
launches Nos. 1, 3, and 4	3,000	Drawing instruments	700
steam-tug *Frolic* (dismantled)	200	Office furniture	700
quarter-boats	5,000	Printing-press, etc	250
ffs, etc	50	Current meters and outfit	1,500
ts	2,800		
ls and appliances	550	Total	36,750

Appropriation for surveys of Mississippi River.

launches, Nos. 5, 6, 7	$5,400
rent meters and outfit	600
ft	150
ls and appliances	50
Total	6,200

JAS. L. LUSK,
First Lieut. of Engineers,
Secretary and Disbursing Officer Mississippi River Commission.

mized statement of expenditures for Mississippi River Commission, act of July 7, 1884, from July 1, 1887, to June 30, 1888.

Items.	Amount.
services	$10.00

SUMMARY.

nce July 1, 1887		$3,501.14
nditures to June 30, 1888	$10.00	
nsferred to credit of appropriation for improving Mississippi River—no limit re-imbursement)	3,490.95	
		3,500.95
Balance available		.19

mized statement of expenditures for surveys of Mississippi River, acts of July 5, 1884, and August 5, 1886, from July 1, 1887, to June 30, 1888.

Item.	Amount.	Item.	Amount.
sistant engineers	$6,450.00	Transportation	$17.80
rks, printer, and watchmen	1,651.00	Mileage	97.92
nts and supplies	34.00	Miscellaneous	240.83
nt	975.00		
el	130.69	Total	9,597.24

SUMMARY.

ance July 1, 1887	$10,481.05
pended to June 30, 1888	9,597.24
Balance available	883.81

List of civilian engineers employed during the year ending June 30, 1888, *on work of and harbor improvement in charge of Capt. Charles F. Powell, Corps of Engineers, under the river and harbor appropriation act approved August* 15, 1886.

Name and place of residence.*	Time employed (months).		Compensation per month.	Where employed.	Work on which ployed.
	M.	*d.*			
J. A. Ockerson, Saint Louis, Mo.	6		$200	Saint Louis, Mo.	Surveys Missi River.
L. L. Wheeler, Saint Louis, Mo.	6		175	...do	
E. H. Twining, New York	12		175	New York	
Kivas Tully, Saint Louis, Mo.	11	2	125	Saint Louis, Mo.	

* Employed in surveys of Mississippi River.

CHAS. F. POWELL,
Captain of Engineers,
Secretary Mississippi River Commissio

B 1.

ELEVATIONS AND DESCRIPTIONS OF SECONDARY TRIANGULATION STATIONS BETW CAIRO, ILL., AND DONALDSONVILLE, LA.

OFFICE OF THE MISSISSIPPI RIVER COMMISSION,
2828 *Washington avenue, Saint Louis, Mo., May* 31, 18

There is appended hereto a list of secondary triangulation stations between Ca and Donaldsonville, whose elevations have been determined by the ordinary level the topographical parties.

The descriptions are mainly derived from the field plats, scale 1 : 10,000, and the fore the azimuths and distances given are approximate and are only intended to in finding the points.

The elevations are referred to the Memphis datum, which is a plane 190.84 feet low the zero of the United States engineer's gauge at Memphis, Tenn., and appro mately 8.13 feet below mean Gulf level at Biloxi, Miss.

The Cairo datum is 13.13 feet below the Memphis datum.

Respectfully submitted.

J. A. OCKERSON,
U. S. Assistant Enginee

Thorn.—Elevation, 312.4. Stone on left bank in open woods 1,150 meters bel railroad depot at Columbus, Ky., and 610 meters below the lower edge of a corn-fie It is about 10 meters from the edge of the bank.

Davis.—Elevation, 310.4. Stone on left bank near east bank of chute, starting opposite Medley's Landing, and 2,200 meters below the head of said chute. It is meters below a corn-field and 400 meters above the upper end of Davis's field.

Hickman.—Elevation, 310.4. Stone on left bank near river, and nearly in line w the lower street of Hickman, Ky., and 30 meters above a warehouse. Also in prolongation of the second street from the river.

Esley.—Elevation, 302.7. Stone on Island No. 8, 1,750 meters above foot of same willows 40 meters from edge of bank.

Mitcham.—Elevation, 300.8. Stone on left bank, 900 meters below foot of Isl No. 8 in the cottonwoods 90 meters from river bank, 150 meters above the lower of a clearing surrounded by timber.

Tennessee.—Elevation, 299.7. Stone on left bank 1,800 meters above Slough La ing, in edge of timber 250 meters above the upper line of R. Gates' field. It is meters outside of road and about 350 meters below the lower end of a willow t head.

State line.—Elevation, 316.9. Stone at east end of road on State line between K tucky and Tennessee, 15 meters from edge of bank and 85 meters east of a State l monument. It is about 1,100 meters below the head of a sand-bar on left bank lower end of Island No. 10 Bend.

Everett.—Elevation, 297.6. Stone on left bank in woods, 40 meters from the ri bank, 170 meters above a corn-field, and 980 meters below a road running west acr the point.

Bass.—Elevation, 285.5. Stone on left bank in woods, 550 meters above Bass Landing, on the inside of a small tow-head, near the west bank of a small chute, 100 meters from the river bank, and 35 meters west of fence around Bass's field.

River-bed.—Elevation, 280.9. Stone in woods about 3 miles below Bass Landing, 25 meters above outlet to an "old river" lake, on left bank, 20 meters from river.

Island No. 14.—Elevation, 282.2. Stone on right bank nearly opposite Reelfoot Landing on Island 14 in edge of timber, 540 meters due east of a prominent bend in the levee back of the island. It is at the upper edge of a sandy chute leading back to the main bank around foot of Island 14 proper.

Mott.—Elevation, 279.5. Stone on right bank, 650 meters below mouth of Robinson's Bayou, 2¼ miles above Gayoso, 50 meters from river bank and 18 meters below a fence around a small corn-field. It is 35 meters northwest of a cabin standing near southwest corner of field.

Mayers.—Elevation, 278.9. Stone in willows on Island No. 15, some 230 meters east of the bank of the chute behind Island No. 15. It is 200 meters east of a small clearing and about 2 miles below Gayoso. Another small clearing lies 225 meters above it.

Perkins.—Elevation, 276.1. Stone on left bank east of chute around Island No. 15 and about 2¼ miles above Blue Bank Bayou. It is in woods, 20 meters from bank of chute, 40 meters below one clearing and 30 meters above another, on the land of Benjamin Perkins.

Island No. 15.—Elevation, 277 7. Stone on left bank at foot of Island 15 in woods, meters above the chute around said island, 5 meters from river and nearly opposite Harris Landing

Johnson.—Elevation, 277.6. Stone on right bank of chute, back of Islands 16 and 17, about 2 miles below the head of same, and in front of the upper end of Peter ott's field. It is between the wagon road and the bank of the chute.

North Base.—Elevation, 271.7. Stone in field opposite foot of Island 18, on land of C. Garrett, 12 meters back of levee, 20 meters below orchard fence, 32 meters below a building standing on the levee, and a mile above Cottonwood Point Landing.

South Base.—Elevation, 272.7. Stone on right bank in field directly back of Cottonwood Point Landing, on land of J. W. Jackson. It is between two roads leading to landing, 115 meters north of one and 50 meters south of the other, and 100 meters northwest of fence joining the two roads near the river.

Franklin.—Elevation, 272.4. Stone on left bank of chute behind Island No. 20, about three-quarters of a mile above the head of Island 21. It is west 25 meters, and meters above the lower end of an inclosed field, and between the wagon road and edge of the bank.

Slater.—Elevation, 270. Stone on left bank, 300 meters below the foot of Island No. 1, near the edge of the bank, 30 meters below the upper edge of a field on land of the Slater heirs.

Obion.—Elevation, 267.3. Stone on left bank on rear bank of a narrow pond, 1,100 meters above the ferry across the Obion River. It is between the ferry road and the bank of the pond, 260 meters above a prominent double slough and in front of a long, narrow clearing.

High water.—Elevation, 266.2. Stone in field on right bank on lower side of Wright's Point, 1¼ miles below the head of the bar, and 1,900 meters below the lower edge of Forsythe's field. It is 125 meters above the lower edge of the clearing, 250 meters below the upper edge, and 22 meters from the edge of the bank.

Puck.—Elevation, 265.5. Stone on right bank in the woods about a half mile above Nebraska Landing. It is 122 meters back from edge of main woods.

Carr.—Elevation, 265.9. Stone on left bank in cottonwoods opposite Barfield Landing. It is nearly opposite the middle of a small tow-head 1,000 meters long, and 155 meters southeast of the east bank of chute around said tow-head. It is 180 meters above a long, narrow clearing. The prolongation eastward of the east and west road at Barfield Landing passes 35 meters south of station.

Flood.—Elevation, 262.33. Stone on right bank on tow-head of Island 25, about half a mile above mouth of Forked Deer River, and 150 meters from river bank in small cottonwood timber.

Daniels Point.—Elevation, 259.1. Stone on right bank on Daniels Point, opposite the foot of Forked Deer Island, near upper edge of field belonging to T. Forrest. It is 22 meters below the upper fence of field, and 400 meters above a road coming out to river bank.

Fletcher.—Elevation, 253.97. Stone on right of bank in woods, 1,150 meters above mouth of Mill Bayou and 35 meters from edge of main bank back of Ashport Bar.

Elmot.—Elevation, 257.5. Stone on right bank near edge, and 640 meters above New Haven Landing, in open ground.

Ashport.—Elevation, 259.1. Stone on left bank at Ashport Landing, inside of field belonging to James Meadows, on south side of road running back along slough. It is 21°—63 meters from southwest corner of main dwelling in yard above slough, and 211° 45′—45 meters from southeast corner of store at landing.

Plum Point.—Elevation, 256.7. Stone on left bank, nearly opposite the foot Island 30, on land of Ed. Friend, in cotton-field, 25 meters from edge of willows. is 430 meters below a point of the main timber which runs to the river bank, and meters due north of a cabin which stands in the cotton-field.

Blackamore.—Elevation, 257.9. Stone on right bank on end of a levee coming to ri bank, 100 meters below a dike across chute behind Osceola Bar.

Osceola.—Elevation, 255.4. Stone on right bank near edge of same, three-four of a mile below Osceola, and 110 meters above fence along woods to levee.

Yankee Bar.—Elevation, 253.9. Stone on left bank opposite head of Buller Tow-head, in narrow clearing, 28 meters from river bank and 32 meters below lo side of yard at lower end of cotton-field. It is 8 meters from woods.

Lanier.—Elevation, 250.8. Stone on right bank nearly in line with the east side Island 34. It is 112 meters outside of levee, 8 meters inside of fence, and 56 met above the lower corner of field. It is 530 meters below a house at the corner of f and road leading back to woods.

Randolph.—Elevation, 265.2. Stone on left bank on slope of bluffs, 450 meters low stores at Randolph. It is 80 meters below a warehouse, and 30 meters below cabin, on a knoll between a road and the river, which is about 40 meters dist It is 340 meters above a creek in a deep gulch.

Whirlpool.—Elevation, 413.3. Stone on left bank on land of Mrs. Cowhard, meters above lower edge of corn-field on the bluff, 230 meters back from edge of ba and about 100 meters above the lower edge of bluffs, and 410 meters south from treme lower point of bluffs.

Richardson.—Elevation, 245.6. Stone on left bank, nearly a mile below the bl 114° 20′—850 meters from Richardson's gin, 555 meters above a road leading b from the river, 76 meters outside of levee, and 12 meters from river bank.

Cole.—Elevation, 245.9. Stone on Island 35 in woods, 25 meters from edge of sa 750 meters below J. Dixon's field, and 370 meters outside of road in front of Geo Pennell's field. It is 100 meters from the edge of the bank at sand-bar and 500 met above a "pocket" lying along the main bank of the island.

Strout.—Elevation, 242.7. Stone on Island 35 in woods directly in line westwa from road along lower side of J. W. Hamilton's field, and 185 meters from west e of said road. It is 400 meters from river bank at the bar.

Pennell.—Elevation, 238.0. Stone on Island 35, about a mile above foot of sa 85 meters from the edge of the bank, near the road along front of a cotton field, 448 meters above the lower edge of the field.

Wallace.—Elevation, 242.8. Stone on left bank, 400 meters below Cedar Po Landing, at upper end of cotton field, 35 meters west of the northwest corner of s field and near the sand-bar at edge of woods.

Bateman.—Elevation, 233.4. Stone in woods on left bank in Bateman's Bend hind Brandywine Island. It is 1,300 meters below Bateman's Bayou, 60 meters abo a narrow field belonging to William Barksdale, 990 meters below Mrs. Massie's fie and near the river bank.

Barksdale.—Elevation, 232.4. Stone on left bank in clearing opposite the head Island 39. It is just back of wagon road along river, 80 meters below a cabin and meters above two cabins standing a short distance above Brinkley Bayou leadi back into the swamp.

Barton.—Elevation, 219.7. Stone in large willows 2 miles above Mound City La ing, and opposite head of Frames Chute. It is about 70 meters from river bank, a tile pipe is set over stone to mark its position. There are three reference sto near by, viz, one above, one below, and one directly back of the stone marking t station.

Frames Chute.—Elevation, 223.3. Stone in woods near bank of Frames Chute, meters above head of Frames Island. There are other stones near by used as re ence stones, and situated similarly to those at Barton.

Wolf River.—Elevation, 223.3. Stone in cotton field 500 meters above foot of Fra Island, 90 meters east of road along chute back of said island, 40 meters west of a ro leading northwest from Wolf River ferry, and about 100 meters south of the juncti of these two roads.

Hopefield.—Elevation, 229.7. Stone in grass and weeds 400 meters above Hopefi railroad incline and 70 meters northeast of levee.

Vance, Sr.—Elevation, 226.5. Stone in cotton field on right bank opposite Memph 140 meters below the western prolongation of Huling street. It is 170 meters sou east of Hopefield Lake and 240 meters northwest of levee and opposite an angle same.

Crawford.—Elevation, 222.3. Stone in woods on President's Island 900 meters ab foot of Vice-President's Island, near the edge of the bank 2,700 meters below t prison.

Leadbetter.—Elevation, 217.0. Stone in woods on President's Island directly oppo Rowley's Landing and near the edge of timber. It is 2,100 meters above the quar tine station.

Jones.—Elevation, 223.3. Stone on levee on right bank 1,150 meters below Jone andimg. It is 400 meters above a sharp angle in the levee where the road intersects

Ensley.—Elevation, 217.8. Stone on left bank 650 meters above the Ensley residence, meters outside of levee and 150 meters above an abrupt angle in the same where vee turns back from the river. It is near the bank.

Matthews.—Elevation, 223.0. Stone on levee 1¼ miles above Reeve's landing, 230 eters below a bend in levee and 200 meters above a curve and fork in same. It is ght at the intersection of an east and west road with the levee and is northeast 1,120 eters from Matthew's gin.

Reeves.—Elevation, 222.5. Stone on right bank on levee 550 meters above Reeves anding and 225 meters below a junction of two levees and a road from the west. It southwest 970 meters from Matthews's gin.

Harris.—Elevation, 219.9. Stone on right bank just outside of fence in front of tton field, 180 meters above dwelling-houses, and nearly opposite Horn Lake Landg. It is 170 meters due south of levee, and 600 meters below forks in same.

Patterson.—Elevation, 217.7. Stone on right bank in woods opposite Collins Landg. It is near the edge of the bank, 310 meters outside of levee, and a half mile be w Harris's field, and some 900 meters above the upper edge of Scanlan's cotton field.

Scanlan's.—Elevation, 219.1. Stone on right bank near Scanlan's Landing, 45 eters outside of levee and 560 meters below the levee running back to Earle's plantion.

Cow Island.—Elevation, 215.9. Stone on left bank in woods on Island No. 47, 30 ters from edge of bank, and nearly opposite a clearing lying a half mile below ves's Bayou.

State Line.—Elevation, 215.3. Stone on left bank in woods, 150 meters above mouth Rock Chute, and directly opposite the end of levee coming to river bank, some 450 ters above Cat Island Landing.

Nelms.—Elevation, 215. Stone on left bank outside of levee in front of Nelms's plantion and near edge of bank. It is 95 meters outside of levee from a point 450 meters ve the south end of Fish Lake.

John H.—Elevation, 212.7. Stone on right bank, just east of road in front of J. rcklerode's place. It is 500 meters south of Harcklerode's gin, 1,280 meters northt of another gin, and 900 meters below Mr. Harcklerode's house.

Peters.—Elevation, 205.8. Stone on right bank of "old river," around Council nd, 10 meters east of levee, near lower end of same, and at Peters' Landing. It is meters below, a road leading west past the cotton-gin and 740 meters southeast said gin on Dr. Peters's plantation.

Bordeaux Chute.—Elevation, 203.1. A tile pipe in briars at lower edge of Carter's d, 10 meters east of a steep bank running due south, which was formerly the main er bank.

Rogers.—Elevation, 201.4. Stone in field on right bank, 900 meters below Rogers's nding. It is 70 meters outside of levee, near the wagon road along river bank, meters above a fence running from levee to river, and 460 meters below a row of ins. There are reference stones near by, the elevations of which are not known.

Wardell.—Elevation, 200.8. Stone in woods on right bank 240 meters above bar at rdin's Point, and 40 meters from the edge of the bank. It is 1,300 meters below a ll clearing, near the bank, which has a cabin near its back edge.

O. K.—Elevation, 222.2. On left bank, on an Indian mound, near the river bank O. K. Landing.

West Base.—Elevation, 198.0. Stone on left bank, 1,500 meters below Harbert's nding, in field 120 meters above its lower end and 40 meters from the river. It is , 75 meters from a cabin.

Turner.—Elevation, 200.3. Stone on left bank, on levee, 435 meters below where it rns abruptly opposite Shoo Fly Bar, and follows down toward St. Francis Tow-head. is 65° 15', 630 meters from southwest corner of cotton-gin on Robert Wilson's place.

Adams.—Elevation, 193.4. Stone on right bank, on land of John Adams, 35 meters ve lower edge of field, 20 meters outside of road, and 60 meters east of house. It 25 meters below fence along lower side of Clarence Quarles' field.

Williamson.—Elevation, 192.5. On right bank, 30 meters back of levee, on William's plantation. It is 12 meters west of fence along levee, and 3 meters below a yard e around house, and 500 meters below a curve in the levee. It is about a mile ve the cotton-gin.

Belfer.—Elevation, 192.8. Stone on left bank near west edge of cottonwood timber a ridge 290 meters west of a narrow chute, 1,500 meters below the head of same, dy opposite the head of Long Lake, and 540 meters west from the levee.

Buzzell.—Elevation, 188.6. Stone on left bank in the cottonwood timber 1¼ miles e Friar's Point Landing. It is 50 meters from river bank, 300 meters north of h, and 540 meters northwest of levee and due south of opening on right bank gh the woods to the Craig Place.

Abbison.—Elevation, 184.4. Stone on right bank 1½ miles below Kangaroo Point in cottonwood timber, 60 meters from the bank and about 250 meters below the lower end of a small tow-head.

Wilkinson.—Elevation, 185.3. Stone on left bank on a small cottonwood tow-head, 830 meters below the lower end of clearing on Miller's Point. It is on the inner side of the tow-head, 80 meters from the river bank.

Island No. 62.—Elevation, 182.3. Stone on Island No. 62, 1,250 meters above its lower end, 300 meters above the lower end of field, and 60 meters from back fence on land belonging to Mr. Decker. It is 108°—120 meters from house.

Saint Louis Landing.—Elevation, 174.9. Stone on right bank in open woods, 60 meters above upper line of B. L. Oliver's field, and 259° 15′—50 meters from a cabin in a small inclosure. It is 18 meters back of wagon road.

Island 66.—Elevation, 174.5. Stone on right bank on Island 66, 1,900 meters below head of same near the edge of the bank outside of the fence in open ground.

Jones.—Elevation, 170.8. Stone on right bank in woods, 610 meters below the lower edge of E. S. Jones's field and near the edge of the bank.

Oliver.—Elevation, 168.7. Stone in woods on Island 66, 500 meters above its lower end and 125 meters east of east bank of chute. It is 212° 30′—150 meters from a house standing just above a large slough.

New Hope.—Elevation, 168.7. Stone in woods on left bank 450 meters below New Hope Landing, 300 meters from river bank, and 265 meters north of old levee. It is 190° 15′—480 meters from gin on Frank Harbatt's plantation.

Mohawk.—Elevation, 170.1. Stone in woods on right bank, some 400 meters below Dawson's field, 30 meters from river bank, and a mile below the mouth of chute of 66.

Knowlton.—Elevation, 166.7. Stone on right bank, on a ridge in the woods, 1,100 meters above the levee crossing the point from Offutt's to Ludlow's Landing, 30 meters from edge of bank and 150 meters outside of wagon-road. It is 295° 05′—1,100 meters from the corner of above-described levee, where it turns abruptly downstream.

Zenor.—Elevation, 170.8. Stone on Zenor Tow-head, 100 meters below the upper point of the high part of the tow-head, and on the main river side near the edge of the bank in willows.

Crews.—Elevation, 167.2. Stone on left bank in woods at foot of Island 68, some 43 meters below county line between Coahoma and Bolivar counties, and 50 meters below a cabin standing in small clearing near river. It is 52° 45′—470 meters from gin on Rose plantation.

Australia.—Elevation, 168.4. Stone on left bank 172 meters outside of levee in front of Australia, near the river bank in open woods. It is 400 meters below Stokes' Bayou and 70° 25′—255 meters from the store and post-office, back of levee at Australia, Miss.

Laconia.—Elevation, 167.8. Stone on right bank at Laconia, Ark., directly in front of and 40 meters from the large cotton-gin at that place.

Magenta.—Elevation, 167.8. Stone on left bank, directly opposite Laconia in woods, 50 meters from the edge of the bank and 44° 25′—190 meters from W. H. Wilson's house. It is about opposite the head of the bar at Hurricane Point.

Hill.—Elevation, 165.3. Stone on right bank, three-fourths mile above Hill's Landing, in a narrow strip of woods, between a field and the river bank, and 115 meters below the head of said clearing, near the bank.

Bee Hive.—Elevation, 164.8. Stone in woods on the right bank opposite Hill's Landing, 70 meters below one clearing and 145 meters above another, on land of James Hill, nearly in line with the outer edges of the two clearings.

Land's End.—Elevation, 164.6. Stone on right bank in woods, one-half mile below Hill's Landing, and 225 meters below the lower end of Hill's lower field. It is on a narrow ridge 155 meters from the river bank.

Foot of 70.—Elevation, 165.5. Stone on right bank at foot of Island 70, in woods on the point of land between chute of 70 and a smaller chute east and about 60 meters above the juncture of same.

Widow.—Elevation, 165.0. Stone on left bank of chute, behind Scrub Grass Tow-head, and 350 meters above the foot of same. It is in the edge of the woods, 465 meters below a clearing lying along the bank of chute.

Victoria.—Elevation, 165.8. Stone on left bank on levee at Victoria Landing. It is 30 meters above fence along upper side of woods, and 238 meters below bend in levee at mouth of Concordia Bayou, on land of James F. Stokes.

Terrene.—Elevation, 163.1. Stone on left bank 700 meters below Terrene Landing, in open ground 100 meters from river bank back of road, and about half-way between two inclosures surrounding dwelling-houses. It is 34° 15′—88 meters from southeast corner of the upper one of these inclosures, and 170° 55′—63 meters from the northwest corner of the other.

Floryville.—Elevation, 161.7. Stone on left bank on outer levee below Rosedale, 65 meters below foot-bridge from inner levee to outer levee, and 80 meters above a fork in the levee. It is 79° 40′—525 meters from the court-house.

Beulah Lake.—Elevation, 160.8. Stone on left bank in woods some 2 miles below where levee starts, back around Beulah Lake near Pride's Point, and near where the upper arm of the lake joins the river at high water, and on the upper side of said arm. It is 127° 37′—530 meters from a house near a lane in a clearing on the lower side of above-described arm of the lake.

Crow Point.—Elevation, 156.0. Stone on the right bank near the main river and 50 meters above the lower end of the old high part of Ozark Island. It is 60 meters above a deep slough which divides the old part of the island from the newer portion, and is 10 meters from the river bank.

Jersey Point.—Elevation, 146.0. Stone on right bank in open ground outside of the levee, about a mile below the foot of tow-head lying just above Jersey Point. It is 215 meters from the levee and directly in front, and 70 meters from a house in a small cultivated field outside of levee.

Island 78.—Elevation, 143.2. Stone on right bank, 180 meters below head of tow-head lying outside of Island 78, and near edge of the bank.

Arkansas City.—Elevation, 147.5. Stone on right bank at Arkansas City, between the railroad and river, 360 meters below the elevator and due east 240 meters from southeast corner of railroad shops.

Gaines' Landing.—Elevation, 144.1. Stone on right bank at Gaines' Landing, 135 meters outside of levee and 170 meters below the junction of front levee with levee running back along John's Bayou. It is 20 meters above a row of three cabins.

Sand Point.—Elevation, 143.6. Stone on left bank in cottonwoods, about the middle of the point opposite Gaines' Landing. It is 50 meters west of the bank of a large slough leaving a high tow-head outside of it. It is 530 meters below the head of this tow-head and 660 meters above an old clearing on same.

Carter.—Elevation, 137.1. Stone on left bank near the river, on the lower side of the Tarpley place, on land of Colonel Randolph. It is in the weeds, 45 meters above the edge of the woods, 10 meters from the edge of the bank, 80 meters below a deep washout, and 228 meters above a levee running across the upper side of the narrow neck of land.

Wallwood.—Elevation, 134.9. Stone on right bank, 900 meters below Chicot Landing, 700 meters below the end of a levee running back through woods, 200 meters below a large, conspicuous rack-heap, imbedded in the bank, and 30 meters from the edge of the bank.

North Base.—Elevation, 132.8. Stone on left bank marking the north end of the Greenville base-line. It is in the line of an east and west fence, 200 meters east of the railroad Y, and north of the railroad 160 meters. It is 282° 15′—260 meters from the engine-house opposite the Y, and 16° 10′—43 meters from the southeast corner of a yard.

South Base.—Elevation, 142.2. Stone on left bank marking the south end of the Greenville base on the levee, 70 meters above where it crosses a slough, and where the road turns back along said slough. It is due west 40 meters from the first cabin above said road.

Whittaker.—Elevation, 135.7. Stone on right bank, three-fourths mile below Bachelor's Bend Tow-head, and 1¾ miles above Craig's. It is in the woods, 90 meters from the river and near a fork in the road, one branch of which runs back to an inclosed field. It is about 20 meters back from a steep, old river bank.

Richardson.—Elevation, 139.9. Stone on left bank on end of levee, 200 meters below head of tow-head, opposite E. Richardson's place. It is 10 meters from the edge of the bank.

Refuge.—Elevation, 132.2. Stone on left bank, 380 meters above the oil works at Refuge, 10 meters outside of the levee and 160 meters above a bend in same where it turns back to rear of oil works. It is 285°—428 meters from the plantation residence.

Davis.—Elevation, 138.5. Stone on right bank, 2¼ miles above Sunnyside Landing, on a detached piece of levee near where the road crosses it. It is a little above a curve in the levee, and is surrounded by timber.

Sedge.—Elevation, 129.2. Stone on left bank in the edge of the woods, on a ridge 550 meters above the lower outlet to Lake Lee. It is 20 meters from the edge of a steep bank.

Hawkins.—Elevation, 128.5. Stone on right bank on upper end of Island No. 87, 1,000 meters below chute at head of same. It is between the fence and wagon-road, 300 meters above the store on land of J. C. Calhoun. It is 218° 40′—583 meters from cotton-gin.

Wickliffe.—Elevation, 123.1. Stone on left bank on Worthington Point, 500 meters below the head of the sand-bar, in the woods, 138 meters from the edge of the bank.

Barnard.—Elevation, 128.2. Stone on right bank on levee, 400 meters below Grand Lake Landing and 440 meters above the street through Grand Lake Village.

Hilliard.—Elevation, 124.6. Stone on right bank, 1 mile below Grand Lake Village, just outside of fence and 20 meters outside of levee, and in front of R. H. Hilliard's place.

Rayner.—Elevation, 123.2. Stone on right bank, 250 meters above Cracraft Landing and 18 meters outside of fence. It is 227°—385 meters from the northeast corner of cotton-gin on Cracraft plantation.

Leota.—Elevation, 122.7. Stone on left bank, 1,380 meters below Leota Landing in woods, 180 meters outside of old levee and 650 meters above the junction of two levees near the Ward place.

Carolina.—Elevation, 120.6. Stone on left bank near the river, 30 meters above the warehouse at Carolina Landing. It is 200 meters above the chute leading back across the point.

Graves.—Elevation, 123.4. Stone on right bank, 1¼ miles below the levee running back from Sterling Landing. It is near the river bank in the grass at the head of the sand-bar and directly opposite to Carolina Landing.

Friedlander.—Elevation, 118.9. Stone on right bank 1,100 meters below upper Ashton Landing, in a yard in front of and near to a cabin of a fisherman.

Vista.—Elevation, 120.3. Stone on right bank, 1,150 meters below Dr. Wm. McCullough's house, on the levee, and has a tripod standing over it.

North Base.—Elevation, 111.5. Stone on right bank marking the north end of Lake Providence base line. It is in the southwest part of the town of Lake Providence, in the southern prolongation of Hood street, near a fence bounding a cotton field. It is 10° 45′—250 meters from the court-house, and 161° 15′—270 meters from a church.

Shipland.—Elevation, 112.9. On left bank in woods, 2¼ miles below Shipland Landing, 115 meters from river bank, on a ridge. Concrete block.

Farland.—Elevation, 109.7. On left bank three-fourths mile above Island 95, at edge of cottonwoods, 50 meters above lower end of slough, behind the sand-bar; about 80 meters back of station is a small open grass plat on a short ridge. Concrete block.

Bass.—Elevation, 110.6. Concrete post on right bank, 700 meters below Bass Landing, outside of fence and directly in front of two cabins standing in field 25 meters distant.

Hays.—Elevation, 112.7. Concrete post on left bank, 730 meters above store at Hays' Landing, 28 meters below a fence running from the levee to the river, and 80 meters above the timber lying along the levee, which is 265 meters back of station.

Stamboul.—Elevation, 116.8. On right bank near lower end of a levee, 665 meters below a levee running back to Stamboul plantation, and near the bank of a chute behind a bar extending down to Wilton.

No Place.—Elevation, 104.6. On left bank near woods, 1¼ miles above Tennessee Landing, near the edge of the bluff-bank behind the sandbar, and 343′ 05′—140 meters from a cabin standing outside of field.

Foster.—Elevation, 101.2. On right bank in woods on a small cottonwood tow-head, opposite Chotard's. It is 700 meters from the upper end of tow-head, 600 meters from lower end, 140 meters from the west bank, and 230 meters from east bank.

Burleigh.—Elevation, 106.6. On left bank between fence and road, 65 meters below line between Burleigh and Magna Vista plantations. It is 50° 30′—60 meters from Burleigh store, and 273° 30′—280 meters from Magna Vista store.

Albemarle.—Elevation, 107.9. On left bank 1,000 meters below Ingomar Landing, in chute on a levee in the woods, 35 meters from the edge of the bank. It is 312° 30′ from a church near Ingomar Landing.

Henderson.—Elevation, 99.8. On right bank in the edge of the woods, 1 mile above Henderson Landing and 85 meters from edge of the bank and 60 meters above the line between Bell and Henderson plantations prolonged to the river. Wooden hub.

Gynn.—Elevation, 102.5. On left bank, 550 meters below Brunswick Landing. On the point at the head of the sand-bank and 104° 30′—630 meters from Mrs. Gwyn's store. Wooden hub.

Willows.—Elevation, 93.9. On left bank in the willows, 190 meters from the bank and nearly in line with the outer bank of Island 102 and about opposite the head of same island. Nail in wooden hub.

Eagle.—Elevation, 100.5. On left bank, one-half mile below Island 102, in edge of the cottonwood timber, 275 meters outside of fence and 570 meters below the upper end of timber. Concrete block.

Crane.—Elevation, 98.2. On right bank near the river, on Mrs. Crane's plantation, in a clearing and 190 meters above the lower end of same. It is 199° 55′—150 meters from a cabin in said field. Wooden hub.

Harris.—Elevation, 100.8. On right bank, in field at lower end of woods, 600 meters above Grant's Canal. It is 170° 05′—435 meters from intersection of levees above said canal and 70 meters from edge of bank. Nail in a wooden hub.

Northeast Base.—Elevation, 98.3. Stone marking the upper end of the Delta Base-line. It is on the point above Delta, 135 meters above one levee and 320 meters below another. It is directly in the line of the main street of Delta and 80 meters from the bank at the upper side of the point.

Warrenton.—Elevation, 98.1. Stake on left bank at Warrenton, Miss., 34 meters below cotton-gin and 60 meters above warehouse, near the river bank. The station is marked with 3 bottles buried horizontally and pointing towards center vertical bottle.

Point Pleasant.—Elevation. 96.3. On right bank, 950 meters below Point Pleasant Landing, on levee at a bend in same. It is 46° 37′—300 meters from the southwest corner of the Point Pleasant gin and 15 meters northeast of a building standing near to and outside of levee; 595 meters west the levee runs into Palmyra Lake.

Thrasher.—Elevation, 83.6. On left bank in willows, 1¼ miles above head of Grand Gulf Chute, on a ridge 460 meters back from edge of willows and near the edge of the larger cottonwoods.

Diskaroon.—Elevation, 89.2. On right bank on lower side of Coffee's Point, on an old levee, 420 meters from a right-angle intersection with another levee crossing the point and 200 meters above the lower end of said levee, in front of two houses standing 30 meters from the levee and 50 meters apart.

Bruinsburg.—Elevation, 83.5. On left bank, about one-half mile below Bruinsburg Landing and 270 meters below where levee runs into the river. It is 76° 15′—250 meters from a sharp corner in said levee.

Saint Joseph.—Elevation, 78.9. On the right bank, three-quarters mile below the town of Saint Joseph and 500 meters above the steamer landing. It is 150 meters outside of the old levee and 48 meters outside of the fence, and 225°—930 meters from a gin back of main levee opposite the landing.

Rodney.—Elevation, 80.7. On left bank, about one-half mile below the town of Rodney, 1,000 meters above Rodney Landing, 150 meters above slough and road leading back to bluffs, and on main bank back of bar. It is near the edge of the bank, outside of road leading from town to the landing, and 38 meters from road fence.

Race-course.—Elevation, 78.5. On right bank, 1¾ miles below Waterproof Landing on levee, 108 meters above a bend, 440 meters below forks in levee, and 200 meters above a pond made by a crevasse.

Fairchild.—Elevation, 70.8. On left bank on Fairchild Island, about 2 miles below "Hole in the Wall," 2,600 meters above the foot of the island, and near the edge of the main bank in the cottonwoods. It is due west of the lower end of a clearing lying above Fairchild's Creek, on east side of chute.

Bluff.—Elevation, 84.4. On left bank at foot of bluff, 1,000 meters below Green's Bayou, and 140 meters below another bayou or creek, and three-quarters mile above Grafton Place.

West Base.—Elevation, 62.4. Stone on right bank, 225 meters north of levee in weeds, three-quarters mile below lower end of Lake Concordia, and about 125 meters east of the Lake Concordia road. It is 117° 15′—335 meters from junction of two levees, and is nearly due north of where aforesaid road crosses the northern levee. The stone is 14 inches square, and marks the northern end of the Vidalia Base.

Palo Alto.—Elevation, 72.1. An iron "screw-pile" on right bank, 1¼ miles above Vidalia, in D. Minor's cottonfield, 240 meters from the levee and opposite a curve in same. It is 15 meters below the western prolongation of a spur of levee leading towards river bank, and 80° 50′—197 meters from a cotton-gin.

East Base.—Elevation, 68.4. Stone on right bank directly back of the jail at Vidalia, La., 55 meters from Lake Concordia road, and 60 meters from levee and near the southeast side of a ditch. The stone is 14 inches square and marks the east end of the Vidalia Base.

Gaither.—Elevation, 68.7. An iron screw pile, 1¼ miles below Vidalia, 2½ meters east of fence on east side of main road, and 380 meters north of levee. It is 64° 30′—740 meters from Gaither's gin, and 221° 10′—970 meters from high boundary stone near levee.

Carthage.—Elevation, 71.1. Stone on left bank, 600 meters below center of St. Catharines Creek on Mrs. Minor's plantation, 70 meters below a road leading south, and 30 meters from bank.

Minor.—Elevation, 69.6. Stone on left bank on Mrs. Minor's plantation, about 2½ miles below mouth of St. Catharines Creek, one-half mile below the head of sand-bar, in line with the lower end of field and between road and river bank, in the grass.

Lemley.—Elevation, 70.3. Stone on left bank opposite foot of Natchez Island, on land of Mark Lemley near the bank, outside of the road and 13 meters from the fence, and 40 meters above angle in same. It is 150 meters below a group of five houses.

Ivanhoe.—Elevation, 70.9. Stone on left bank on Ivanhoe plantation, owned by Washington Ford. It is three-fourths mile above Morville Landing, in open ground, directly in line with fence leading back to woods, and 75 meters from the corner. It is 55 meters from the river bank and 45 meters above a fence surrounding a group of cabins, etc.

Ford.—Elevation, 66.4. Stone on left bank opposite Warnicott gin, 13 meters from river bank in edge of cottonwoods, 17° 45′—640 meters from Washington Ford's house. Surrounding trees are blazed.

Warnicott.—Elevation, 67.2. Stone on right bank, 900 meters below Morville Landing on Warnicott plantation, 60 meters from river bank and end of levee, 253° 50′—710 meters from gin chimney. Two blazed pecan trees stand 88 meters northwest and 45 meters south, respectively.

Ashley.—Elevation, 61.3. Stone on right bank, 2¼ miles below Morville Landing, 400 meters below end of levee at river bank, 30 meters above woods, 140 meters outside of levee on Ashley plantation. It is 331° 47′—810 meters from a gin chimney, and an old brick oven stands 30 meters west.

St. Catherines.—Elevation, 69.4. Stone on left bank, on St. Catherines Towhead, near the river bank, opposite Ashley gin chimney, and about 600 meters below the head of the large cottonwood timber.

There are three trees blazed with a triangle standing in the following positions: first, WNW. 14 meters; second, N. by E. 14 meters; third, SSE. 5 meters.

Ellis Cliff.—Elevation, 238.8. Stone on the left bank on the bluff back of Hutchins' Landing on what is known as Ellis Cliffs, on the property of Mr. Butler. It is near the north edge of the bluffs 286° 45′—290 meters from Liggan's store at Hutchins' Landing.

Pecan.—Elevation, 70.5. Stone on right bank on levee near bank one-half mile above Green's store, behind the willow bar. It is on the levee crossing from Ashley plantation, and 80 meters south of junction of levees, and at junction with small levee running west.

Fairview.—Elevation, 64.7. Stone on right bank on the Fairview plantation, 1,340 meters below Green's store. It is 42° 50′—320 meters from southwest corner of gin, 300 meters below road leading past gin and near east and west road, and also very near the levee built after the survey of 1883.

Rosenthal.—Elevation, 69.1. Stone on right bank on the Surgett-Ashley plantation. It is 900 meters below Fish Pond, 600 meters above mouth of a bayou, and on a levee 287° 15′—250 meters from gin.

Palmetto.—Elevation, 60.3 (approximate). Stone on left bank, 900 meters above Jager's Landing, on low ground 25 meters back of willows, 300 meters above lower point of same, and 240 meters southwest of main river bank. It is 44° 17′—500 meters from Palmetto gin-stack, 134° 15′—910 meters from Jager's store.

Roseland.—Elevation, 60.5. Stone on right bank on south side of and near to the hedge dividing Fairview and Roseland plantations, and 570 meters from river bank. It is 20° 30′—575 meters from Walton gin chimney, and 100 meters west of a ditch running to the hedge.

Winn.—Elevation 63.2. Stone on left bank in Dead Man's Bend, opposite Fritz Island on Joe plantation, and on land belonging to John Winn. It is between the wagon road and the fence 15 meters from the river bank, 298 meters above a fence running back to woods, 202° 37′—2,235 meters from Blackhill's gin, and 49° 00′—120 meters from nearest cabin.

Fritz.—Elevation, 60.4. Stone on right bank on Fritz Island, 2,200 meters below the head of same, and 150 meters below the foot of a small towhead. It is 10 meters from the bank, in the edge of the timber.

Home Place.—Elevation, 62.3. Stone on right bank near main bank at foot of Fritz Island, back of road, and 40 meters below a road leading back through field, 40 meters above the old Home Place store, and directly in front of said store, 78 meters distant.

Wilds.—Elevation, 60.2. Stone on right bank, about 1¾ miles above Bougere Landing, in woods, 35 meters from the river bank, about 120 meters above boundary fence between Home Place and Bougere plantations. It is about 230 meters above lower point of cottonwoods, on a ridge.

Allaway.—Elevation, 62.5. Stone on left bank, 2 miles above Jackson's Point Landing, on land of W. L. Jackson, 20 meters back of road and 1,050 meters above road along the upper side of Newcome's Lake. It is 80 meters above a cabin, and 50 meters below another, and 80 meters below end of levee. The surrounding trees are blazed.

Pullen.—Elevation, 58.8. Stone on right bank, 300 meters above Black Hawk Landing, in the grass, 50 meters outside of levee and 10 meters from edge of bank. It is 189° 15′—230 meters from northeast corner of Black Hawk store.

Northeast Base.—Elevation, 60.3. Stone on right bank, 1¼ miles below the head of Point Breeze, 35 meters west of road in field. It is 120 meters above a house, 190 meters below another house, both of which are near the road. A china tree stands southwest 86 meters. Two pecan trees near the bank are 60 and 63 meters distant, respectively. The stone marks the north end of Lum's Point Base, and is 14 inches square.

Southwest Base.—Elevation, 60.2. Stone on right bank marking the lower end of Lum's Point Base. It is on Lum's plantation, 600 meters above Lum's Landing, 355° 10′—90 meters from northwest corner of Lum's house, 229° 45′—860 meters from cotton-gin. It is 15 meters from thorn tree south of road, and 23 meters from thorn tree in lane, a pecan tree near garden in house lot is 49 meters distant.

Rock Hill.—Elevation, 376.0 (approximate). On left bank on highest part of bluff back of Clark's Lake, about a mile from the river. The mark is an iron rod set in cement. It is 251° 10′ from Langside gin stack.

Tarbert.—Elevation, 60.6. On left bank about a mile below Tarbert Landing, 36° 55′—1,345 metres from the Tarbert gin. It is 10 meters outside of fence along river bank in line with the upper side of a yard around two houses and a little above a road leading back through field. Copper tack in wooden hub.

Old River.—Elevation, 55.3. On right bank, 200 meters below outlet to Raccourci Lake, or "Old River," in lower part of bend below Red River. It is 10 meters from river bank, 57° 10′—55 meters from a cabin, and 117° 15′—155 meters from another cabin. Iron rod in cement.

Leatherman.—Elevation, 51.4. On right bank directly opposite Lower Tunica Landing in open woods, 90 meters below clearing and 250 meters above a cotton field. It is 30 meters from bank and is marked with an iron rod in cement.

Stump.—Elevation, 55.7. On right bank three-fourths of a mile below Tunica Landing, near the edge of the bank a short distance above the head of sand-bar, and 1,000 meters below a cotton field. It is a large cotton-wood stump with a copper tack in top.

Stevenson.—Elevation, 46.7. On right bank about 2 miles below Tunica Landing, and half a mile above Greenwood Landing in cotton-wood timber. It is 40 meters from the river bank and 250 meters below a slough coming out to the river. Copper tack in a wooden hub.

Douglass.—Elevation, 45.7. On right bank in the woods about half a mile above Tunica Island, 40 meters from the river. Copper tack in wooden hub.

Sims.—Elevation, 42.6. On right bank one-half mile below Sebastapol Landing on lower side of Point Raccourci in the small cotton-woods 140 meters from river bank and 1,750 meters above "Rens Ditch." Iron rod in cement.

Rens Ditch.—Elevation, 41.9. On right bank 18 meters above Rens Ditch, 80 meters from edge of willows and a little more than a mile above Raccourci Landing. Iron rod in cement.

Cat Island.—Elevation, 45.2. On left bank opposite Morganza Crevasse on land of Mr. Harvey. It is 68 meters above a narrow inclosed field. It is 225 meters outside of levee and 25 meters from river bank. Copper tack in hub.

Saint Maurice.—Elevation, 51.9. On right bank on levee 1,030 meters below Blue Store and 1,200 meters above Red Store Landing. It is 90 meters above a bend in the levee and 130 meters below lower side of lane leading back to the Saint Maurice quarters. Copper tack in stub.

Taylor.—Elevation, 47.2. Stone on right bank 500 meters below Bertrand's Landing on the Burrow Plantation 10 meters outside of levee in line with upper fence of a yard. It is 245 meters below a junction of levees.

Porche.—Elevation, 46.7. On right bank 445 meters below Bertrand's Landing on outside levee 40 meters above the junction of two levees from above and on Bertrand plantation. Copper tack in wooden hub.

Labry.—Elevation, 46.7. On right bank about a mile above Waterloo Landing, 250 meters above upper line of Alaska plantation and 15 meters outside of levee. It is 204° 35′—630 meters from Alaska sugar-house.

Lebret.—Elevation, 47.4. Stone on left bank a mile above Waterloo Landing, 150 meters above lower end of J. DeMorley's field, near bank 10 meters outside of fence.

Waterloo.—Elevation, 47.7. Stone on right bank 195 meters below Cook's Landing, 35 meters outside of main levee, 18 meters from river bank, 195° 15′—680 meters from the Nina sugar house and opposite a short spur of levee having a right angle turn outside of main levee.

Slaughter.—Elevation, 97.9. On left bank 325 meters above incline at Port Hickey, 32 meters outside of the railroad near the edge of the bluff. Copper tack in a wooden hub. A stone stands in line of fence 62 meters back of hub.

Wildwood.—Elevation, 45.6. Stone on right bank about one-fourth of a mile below Mount Pleasant Landing and 550 meters above Wildwood Landing on Wildwood plantation. It is 50 meters outside of levee near the river bank and 800 meters below an old crevasse pond.

Clarke.—Elevation, 41.8. On right bank opposite New Springfield Landing, 400 meters from the upper side of clearing on the point, 170 meters below the lower edge of field, 239° 45′—150 meters from a cabin below field, and near the edge of the bluff bank at head of bar.

Chamberlain.—Elevation, 37.8. Stone on right bank three-fourths of a mile above Grossman's Landing in grass 50 meters outside of levee directly in front of Benjamin Chamberlain's house, and 365 meters below school-house.

China.—Elevation, 41.6. Stone on right bank 260 meters below Grossman's Landing, 296° 00′—865 meters—from Orange Grove sugar-house, in line with said sugar-house and store, 380 meters from latter, 50 meters from the bank, and 213 meters outside of levee.

Swamp.—Elevation, 38.3. On lef tbank, directly opposite Lobdell's Landing an Belle Vale sugar-house. It is in the edge of the woods near the river bank, on lowe side of Thomas Point.

Belle Vale.—Elevation, 35.9. On right bank, 245 meters below the road betwee the T. J. Thompson and Belle Vale plantations, 273° 35′—365 meters from a chur on west side of road, 89° 45′—210 meters from Belle Vale sugar-house, 460 mete from levee, and 200 meters above Lobdell's Landing.

Allsworth.—Elevation, 72.0. Stone on left bank on Scott Bluffs, 100 meters belo Scotland Landing in cotton field, 20 meters from river bank, 30 meters above a fenc and 100 meters above a bayou leading to river.

Belair.—Elevation, 44.0. Stone on right bank on levee three-fourths of a mile belo Point Place Landing on Belair plantation, 253° 30′—460 meters from Belair sug house and 210° 35′—160 meters from Mrs. Von Phul's residence.

Montesano.—Elevation, 72.3. Stone on left bank at Montesano Landing on the bl and near the edge of same. It is on a mound just above a gulley in the bluff on la of Colonel Favrot.

Von Phul.—Elevation, 40.7. On right bank on Poplar Grove plantation at edge bank 12 meters outside of levee, 140 meters above forks in levee, and 1,080 met above Anchorage Landing. It is 279° 30′—590 meters from NE. corner of Popl Grove sugar-house and 208° 45′—880 meters from Anchorage sugar-house.

Anchorage.—Elevation, 40.9. On right bank 190 meters above Anchorage wa house, 16 meters outside of levee and in line of fence running back from the r toward a long row of negro quarters. It is 281° 45′—465 meters from southeast c ner of Anchorage sugar-house.

Barracks.—Elevation, 62.4. On left bank 100 meters above the barracks on milit reservation, 90 meters below the upper fence and near the edge of the bluff bank. is 128° 35′—242 meters from the "Flag Staff."

North Base.—Elevation, 36.7. Stone on left bank 700 meters south of city limit Baton Rouge, 112 meters back of levee and about 80 meters west of railroad. I 27° 00′ 998 meters from the university cupola and 147° 05′—1,028 meters from the w end of McCullan sugar-house. The stone is 14 inches square and marks the no end of Baton Rouge Base.

South Base.—Elevation, 35.2. Stone on left bank 2,250 meters below the city li of Baton Rouge, inside of the levee at an angle in same where it turns back aro some crevasse ponds and about 10 meters from top of levee, between the road and le It is 56° 15′—1,240 meters from McCullan sugar-house and 121° 45′—1,640 meters f the next sugar-house below. The stone is 14 inches square and marks the lower of Baton Rouge base.

Boulien.—Elevation, 34.2. On right bank about a mile above Union Store Land 380 meters back of levee in field on Boulien plantation 705 meters east of Texas Pacific Railroad, and on west edge of a plantation road, between the road a ditch. It is 320° 10′—325 meters from sugar-house.

Missouri.—Elevation, 36.5. On right bank at Missouri Landing 30 meters out of levee and 190 meters below bend in same. It is 370 meters above hedge mar the lower limit of Missouri Plantation and 331° 00′—850 meters from sugar-ho Copper tack in wooden hub.

Duncan.—Elevation, 37.7. On left bank 870 meters below Laurel Place Land 10 meters outside of levee and 23 meters below a spur of levee running to the bank. It is on the Cottage plantation owned by D. Conrad. Copper tack in wo hub.

Hickey.—Elevation, 43.9. On right bank 580 meters below Saint Mary's Lan on levee 500 meters below tramway running to Saint Mary's sugar-house and n opposite the gate leading to the Shenango sugar-house. It is 237° 10′—405 m from latter sugar-house. Copper tack in wooden hub.

Martin.—Elevation, 32.4. Stone on right bank back of Sardine Point villag meters from the levee, 800 meters above road crossing the Point, and 82° 10′ meters from a sugar-house standing 110 meters above said road.

Cottage.—Elevation, 36.9. On left bank on Cottage plantation on lower s Duncan's Point; 290 meters from the levee, nearly in line with the fence alon rear of negro quarters, 312° 15′—500 meters from Cottage sugar-house and just the tenth ditch below quarters. Copper tack in wooden hub.

Lopez.—Elevation, 36.0. On left bank 1,450 meters above Hollywood Landi the left of the gate near the fence corner in the yard owned by Mrs. Lopez and the levee. It is a short distance above blacksmith shop and opposite an an levee. Copper tack in wooden hub.

Chatworth.—Elevation, 36.4. On left bank 950 meters above Longwood Lan between two levees 120 meters above road leading to quarters and sugar-hou is 170 meters below upper junction of levees, 450 meters above Manchac Cut-o 60°—765 meters from southwest end of Chatworth sugar-house. Copper t wooden hub.

Wood's.—Elevation, 34.7. On right bank, 1½ miles above Australia Landing, 120 meters back of levee, in field on Australia plantation, 40 meters from the road fence and 120 meters above brush. It is 212° 30′—82 meters from corner of levee and 665 meters below upper line of plantation. Copper tack in wooden hub.

Australia.—Elevation, 35.3. On right bank, directly opposite Australia Landing, 308 meters from levee, 155° 52′—425 meters from Australia sugar-house, and in an old road leading from the back gate of Mr. Wood's yard, 220 meters from the gate. Copper tack in wooden hub.

Bend.—Elevation, 36.8. Stone on right bank, in field owned by Daniel Levi, 1,700 meters above National Landing, 140 meters from levee, 240 meters below junction of levees, and directly back 70 meters from the sugar-house.

Manchac.—Elevation, 34.9. Stone on left bank, 650 meters below Manchac Landing, on Manchac plantation, in field near road fence, 28 meters from levee, 150 meters from spur running to river bank, and 125° 05′—845 meters from northwest corner of Manchac sugar-house.

Conrad.—Elevation. 36.9. On left bank, about a mile below Brooksville Landing, 23 meters outside of levee in front of Mrs. Conrad's, 183° 10′—310 meters from one sugar-house. and 277° 37′—1,180 meters from another. Copper tack in cypress stub.

Bailey.—Elevation, 34.9. On right bank, 760 meters below National Landing, on the Resterege plantation, on lower side of Manchac Point. It is 112 meters back of levee and 345 meters above road crossing the point, 95° 03′—290 meters from sugar-house. Copper tack in cypress stub.

Medora.—Elevation, 33.4. On right bank, on the Medora plantation, in the stable-yard, in the corner of the fence back of a bend of the levee 2 miles below National Landing, 58 meters below McWilliams's house, 319° 10′—248 meters from sugar-house. Copper tack in cypress hub.

Woodland.—Elevation, 34.1. Stone on right bank, 1,000 meters above Bayou Plaquemine, 495 meters below a tramway running back to Union sugar-house. It is 50 meters inside of fence back of levee, 305° 15′—745 meters from sugar-house, and 124° 00′—1,650 meters from St. John's Church, in Plaquemine.

Batture.—Elevation, 35.7. On left bank, 150 meters outside of levee on batture in front of Lucky plantation, about 150 meters below a loop in the levee. It is 119° 50′—1,075 meters from Millers' sugar-house, and 25° 15′—425 meters from Le Blanc's sugar-house. Copper tack in wooden hub.

Plaquemine.—Elevation, 35.8. On right bank, 750 meters below Plaquemine Landing, 30 meters below an old fort, 320 meters below Haase street, and 10 meters outside of the levee. Copper tack in a wooden hub.

Gay.—Elevation, 33.3. On right bank, 430 meters above Saint Louis store on Saint Louis plantation, 250 meters above road leading out to the plantation quarters. It is in a pasture near west fence, 98 meters from levee, 171° 50′—385 meters from Mrs. Gay's residence, and 313° 43′—220 meters from store at Boode Landing. Copper tack in wooden hub.

Evergreen.—Elevation, 31.5. On right bank, opposite Tennessee Landing, on Evergreen plantation, 9 meters inside of fence, 205 meters from levee, and 88 meters above the road leading back through the quarters. It is 84° 07′—65 meters from a church (colored), and 10 meters west of a fence running parallel to the road. Copper tack in wooden hub.

Anger.—Elevation, 35.8. On left bank, 1,140 meters above Forlorn Hope Landing, outside of levee, on the Forlorn Hope plantation. The first house above is occupied by Mr. A. Saillon. Copper tack in a wooden hub.

Ventress.—Elevation, 31.8. On left bank, 200 meters below Magnolia Landing, 6° —460 meters from Magnolia sugar-house and 15 meters inside of fence back of levee. Copper tack in wooden hub.

Willow Glen.—Elevation, 35.3. On left bank, at Willow Glen Landing, 12 meters outside of levee and in prolongation of upper side of road leading back to Willow Glen sugar-house. A wooden hub with a hole bored in the top.

Belle Grove.—Elevation, 37.4. On right bank, at Belle Grove Landing on levee, 20 meters below Belle Grove store. A wooden hub painted white.

Rescue.—Elevation, 38.5. On right bank, 20 meters above forks in levee on Rescue plantation, 200 meters below store and 90 meters above road leading back to sugar-house. Wooden hub painted white.

North Base.—Elevation, 29.6. Stone on right bank, 1¼ miles below Bayou La Fourche, 20 meters back of levee, in field just below road leading to sugar-house, and ° 15′—972 meters from said sugar-house chimney.

B2—Geographical positions of tertiary points between Keokuk, Iowa, and Cairo, Illinois.

Station.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″		*Meters.*
Church spire, Hamilton, Ill.	40 23 34.60	91 20 52.85	46 28 30	226 27 50	Worster	2,001.
			125 05 11	305 03 58	Keokuk	3,226.
			112 56 31	292 54 21	Hughes	5,025.
			67 06 30	247 03 23	Warsaw	7,378.
Cupola, Mrs. H. W. Sample's house, Keokuk, Iowa.	40 23 40.93	91 22 42.98	240 26 17	60 27 04	Hamilton	1,961.
			323 55 27	143 55 58	Worster	1,946.
			130 56 55	310 55 59	Hughes	2,648.
			53 51 23	233 49 28	Warsaw	5,200.
			178 30 29	358 30 28	Keokuk	1,639.
Unitarian Church spire, Keokuk, Iowa.	40 23 49.32	91 22 47.62	248 41 02	68 41 52	Hamilton	1,948
			325 34 23	145 34 58	Worster	2,221
			50 52 36	230 50 44	Warsaw	5,271
			128 02 16	308 01 23	Hughes	2,440
			182 43 00	2 43 02	Keokuk	1,401
Presbyterian Church spire, Keokuk, Iowa.	40 23 53.11	91 23 03.69	47 08 18	227 06 36	Warsaw	5,062
			131 56 28	311 55 46	Hughes	2,079
			199 08 36	19 08 48	Keokuk	1,357
			320 00 51	140 01 36	Worster	2,540
Presbyterian Church spire, Warsaw, Ill.	40 21 33.11	91 26 14.81	90 17 00	270 11 06	Fox River	12,88
			140 27 11	320 25 11	Yellow Banks	6,86
			222 24 19	42 24 41	Warsaw	1,18
M. E. Church spire, Warsaw, Ill.	40 21 40.25	91 26 05.39	137 50 44	317 48 38	Yellow Banks	8,84
			89 19 03	269 13 03	Fox River	13,16
			221 23 37	41 23 53	Warsaw	87
Flag 5	40 13 55.08	91 30 35.62	8 51 50	188 51 02	Canton University	11,3
			13 04 35	193 04 06	Cougill	4,6
Flag 7	40 11 21.08	91 30 47.92	12 41 21	192 40 41	Canton University	6,6
			283 50 10	103 54 01	Lima Lake	8,7
Flag 8	40 09 15.84	91 30 10.03	41 53 44	221 52 40	Canton University	3,5
			256 52 10	76 55 37	Lima Lake	7,7
			198 26 46	18 29 25	Gillham	18,3
Flag 9	40 09 18.19	91 31 02.55	259 06 34	79 10 35	Lima Lake	8,9
			22 25 36	202 25 06	Canton University	2,9
			202 06 49	22 10 02	Gillham	18,7
Church spire, Canton, Mo.	40 07 46.38	91 31 19.63	243 52 22	63 56 34	Lima Lake	10,2
			100 17 03	280 16 44	Canton University	7,
La Grange College	40 02 54.59	91 29 56.16	208 13 53	28 17 11	Lima Lake	15,
			163 35 51	343 34 38	Canton University	9,5
			328 31 30	148 34 46	Quincy	13,
			0 43 28	180 43 21	Nelson	19,
Flag 12	40 02 50.16	91 28 54.33	155 52 06	335 50 13	Canton University	10,
			86 11 39	266 10 58	La Grange	1,
Flag 13	40 00 26.47	91 28 46.15	158 24 41	338 23 55	La Grange	4,
			322 27 45	142 30 16	Quincy	9,
Flag 16	39 57 56.58	91 26 46.26	153 02 09	333 00 05	La Grange	10,
			314 00 20	134 01 34	Quincy	3,
Court-house, Quincy, Ill.	39 56 06.57	91 24 28.17	147 37 40	327 34 08	La Grange	14,
			49 07 32	229 03 55	Nelson	10,
			8 58 28	188 57 19	Heather	16,
Catholic Church spire, Quincy, Ill.	39 55 03.63	91 24 17.01	58 51 50	238 48 06	Nelson	9
			11 11 51	191 10 35	Heather	14
Flag 20	39 51 02.08	91 25 36.72	7 44 11	187 43 46	Heather	6
			110 36 09	290 33 16	Nelson	
Flag 21	39 51 06.05	91 25 56.31	111 11 37	291 08 57	Nelson	
			3 49 28	183 49 15	Heather	
Flag 24	39 45 37.72	91 21 29.08	269 42 38	89 46 12	Seehorn	
			339 22 37	159 23 57	Hannibal	
Elevator (S. E. gable) Hannibal, Mo.	39 42 19.21	91 20 38.94	227 38 15	47 41 16	Seehorn	
			315 33 14	135 34 02	Hannibal	

B2—Geographical positions of tertiary points between Keokuk, Iowa, etc.—Continued.

Station.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″		*Meters.*
Flag 26	39 41 55.52	91 18 58.76	212 23 30	32 25 27	Seehorn	8,159.2
			286 56 22	107 04 05	Gard	18,090.0
			28 01 57	208 01 41	Hannibal	1,250.8
Flag 28	39 39 02.19	91 15 17.29	125 53 20	305 50 43	Hannibal	7,239.5
			269 41 25	89 46 47	Gard	12,025.0
			323 58 34	144 00 06	Red House	5,842.3
Flag 30	39 36 33.07	91 11 13.55	127 10 01	307 04 48	Hannibal	14,648.4
			86 57 26	266 56 22	Red House	2,381.6
			233 09 00	53 11 46	Gard	7,765.6
Flag 32	39 33 59.56	91 09 21.40	132 22 09	312 19 54	Red House	6,840.8
			200 39 13	20 40 48	Gard	10,034.7
			280 17 13	100 22 33	Rockport	12,205.4
			326 00 44	146 03 59	Salt River	13,088.8
Flag 33	39 33 16.90	91 09 50.34	319 58 30	140 02 03	Salt River	12,452.8
			201 33 41	21 35 34	Gard	11,511.3
Flag 34	39 32 52.41	91 05 40.80	171 28 08	351 27 22	Gard	11,588.1
			270 58 18	91 01 18	Rockport	6,744.1
			346 51 21	166 55 15	Salt River	9,018.3
Flag 35	39 32 07.84	91 06 33.66	131 40 02	311 36 00	Red House	12,121.9
			177 57 08	357 56 56	Gard	12,842.7
			261 02 49	81 06 22	Rockport	8,103.9
			335 56 52	155 58 20	Salt River	8,113.6
Flag 36	39 28 30.74	91 03 33.52	54 26 13	234 25 46	Salt River	1,228.6
			204 58 22	25 00 01	Rockport	8,773.8
			267 04 42	87 09 51	Long	11,629.3
			316 08 03	136 10 46	McLean	8,872.1
Flag 37	39 26 15.00	91 00 07.78	120 25 09	300 22 32	Salt River	6,862.6
			174 18 45	354 18 13	Rockport	12,198.8
			234 31 33	54 34 31	Long	8,223.6
			330 59 53	151 00 26	McLean	2,530.4
Flag 39	39 25 44.75	91 00 42.59	232 50 25	52 53 45	Long	9,446.9
			178 20 47	358 29 37	Rockport	13,076.9
Flag 43	39 23 15.03	90 56 13.90	281 15 56	101 21 22	Bellview	12,552.5
			303 59 59	124 01 00	Clarksville	2,790.4
Flag 44	39 21 52.31	90 51 48.79	269 07 11	89 09 49	Bellview	5,964.7
			103 48 54	283 47 07	Clarksville	4,152.3
Flag 45	39 21 20.46	90 52 34.63	261 20 50	81 23 57	Bellview	7,142.7
			123 54 44	303 53 26	Clarksville	3,536.5
Flag 46	39 19 54.77	90 48 36.33	323 17 02	143 20 32	Hamburg	13,306.3
			200 04 13	20 04 49	Bellview	3,953.6
			9 44 54	189 44 15	Saltpeter	8,731.2
Flag 47	39 19 19.01	90 49 21.32	316 37 37	136 41 35	Hamburg	13,155.0
			206 48 11	26 49 15	Belleview	5,396.9
			3 02 59	183 02 48	Saltpeter	7,513.0
Flag 48	39 17 34.03	90 45 51.37	51 53 01	231 50 38	Saltpeter	6,906.4
			162 09 31	342 08 22	Belleview	8,461.4
			327 42 53	147 41 39	Hamburg	7,486.5
Flag 49	39 17 10.48	90 46 51.08	172 27 17	352 26 46	Belleview	8,857.2
			48 31 32	228 29 46	Saltpeter	5,341.4
Flag 51	39 14 40.63	90 44 29.76	98 21 33	278 18 18	Saltpeter	7,469.9
			161 15 47	341 13 47	Belleview	14,153.0
			295 41 32	115 42 26	Hamburg	2,265.3
Flag 52	39 11 27.50	90 42 41.88	125 13 31	305 09 08	Saltpeter	12,213.7
			173 44 13	353 43 59	Hamburg	5,002.9
			21 59 01	201 57 00	Knox	11,396.8
Flag 53	39 10 33.34	90 44 05.68	14 12 21	194 11 22	Knox	9,179.4
			322 14 41	142 17 21	Peets	9,921.4
			192 25 40	12 26 19	Hamburg	6,802.6

B 2—Geographical positions of tertiary points between Keokuk, Iowa, etc.—Continued.

Station.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″		*Meters.*
Flag 56	39 04 43.95	90 41 12.47	171 13 15	351 12 04	Hamburg	17,625.1
			213 09 16	33 10 06	Peets	3,497.7
			43 30 07	223 27 45	Kilham	7,865.3
Flag 58	39 02 17.78	90 41 54.48	337 07 34	157 08 33	Cahill	5,803.1
			264 51 15	84 52 07	Wilson	1,983.1
			74 47 03	254 45 08	Kilham	4,563.5
Flag 59	39 01 56.98	90 43 04.23	320 05 38	140 07 21	Cahill	6,133.0
			78 26 56	258 25 45	Kilham	2,781.9
Flag 63	38 57 29.89	90 40 58.29	289 29 56	109 31 08	Keel	2,909.3
			194 21 16	14 21 40	Cahill	3,644.5
Flag 67	38 55 55.69	90 28 43.64	62 58 02	242 56 08	Point Landing	4,893.2
			133 42 19	313 39 58	Thomson	7,484.6
			162 55 41	342 55 05	Rivermouth	4,717.7
			206 45 26	26 46 26	Grafton	5,070.1
Flag 68	38 56 11.79	90 29 48.48	140 31 23	320 29 43	Thomson	6,055.3
			45 46 34	225 45 21	Point Landing	3,902.3
			223 38 08	43 39 48	Grafton	5,569.9
Flag 2	38 57 35.75	90 25 18.39	118 27 58	298 26 49	Grafton	3,023.8
			275 51 22	95 53 20	Elsah	4,557.1
Flag 3	38 56 54.35	90 22 41.10	222 36 59	42 37 18	Elsah	1,101.7
			281 45 59	101 47 36	Starr	3,810.8
Simpson 36	38 54 40.35	90 13 15.23	353 57 16	173 57 19	Nicholson	1,231.1
			311 38 04	131 38 45	Saw-mill	2,094.0
School-house No. 5, Alton, Ill.	38 53 31.77	90 10 12.27	310 31 51	130 32 48	Russell	2,874.8
			12 41 43	192 41 38	Glass Works	939.5
Catholic Church, Alton, Ill.	38 53 25.88	90 10 39.34	300 43 21	120 44 35	Russell	3,300.6
			328 44 57	148 45 09	Glass Works	859.4
Station A 77	38 40 18.51	90 10 44.46	86 39 24	266 38 17	Stand Pipe	2,592.3
Flag 4	38 42 45.29	90 12 53.54	325 24 46	145 26 07	Station A 77	5,497.0
			353 30 16	173 30 30	Stand Pipe	4,708.0
Smoke stack, Vulcan Iron Works.	38 33 04.21	90 13 54.21	257 23 01	77 29 03	Clark's Mound	14,392.1
			49 55 24	229 53 08	Forder	6,921.9
			332 21 57	152 23 11	Dreyer	6,190.8
Flag 5	38 34 29.45	90 13 53.47	340 37 21	160 38 34	Dreyer	8,600.6
			267 53 50	87 59 51	Clark's Mound	14,036.2
Flag 6	38 31 59.50	90 15 43.98	345 12 40	165 12 57	Flag 7	2,574.7
			302 14 05	122 16 27	Dreyer	6,538.9
Flag 7	38 30 38.77	90 15 16.85	281 34 54	101 36 59	Dreyer	4,975.6
			27 19 50	207 18 23	Twin Hollows	7,406.9
Flag-staff, Jefferson Barracks.	38 30 11.58	90 16 37.24	122 43 13	302 42 38	Forder	1,600.8
			271 20 12	91 23 07	Dreyer	6,824.6
			332 49 45	152 51 34	Gummersheimer	9,273.5
Flag 8	38 26 51.81	90 16 52.63	230 10 05	50 13 10	Dreyer	9,369.6
			111 10 27	291 09 59	Twin Hollows	1,156.1
			294 23 55	114 25 53	Gummersheimer	5,059.
Flag 9	38 23 45.27	90 19 05.72	299 22 16	119 24 25	Boean	5,766.8
			199 12 31	19 13 26	Twin Hollows	6,543.
			147 35 25	327 35 06	Merrimac	1,406.9
			351 18 35	171 19 12	Salt Bluff	9,657.6
Flag 10	38 21 43.31	90 21 35.21	263 50 11	83 53 52	Boean	8,705.
			210 08 46	30 10 00	Merrimac	5,722.
			318 38 44	138 40 54	Salt Bluff	7,706.6
			20 03 29	200 02 54	Sulphur Springs	4,011.1
Flag 11	38 21 03.34	90 21 11.00	254 58 03	75 01 29	Boean	8,353.
			200 18 01	20 19 00	Merrimac	6,589.
			37 45 21	217 44 31	Sulphur Springs	3,207.
			315 18 49	135 20 44	Salt Bluff	6,403.

—Geographical positions of tertiary points between Keokuk, Iowa, etc.—Continued.

Station.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″		*Meters.*
Flag 12	38 19 18.65	90 21 51.08	4 55 36	184 55 20	Herculaneum	7,492.4
			124 57 05	304 56 40	Sulphur Springs	1,208.0
Flag 13	38 15 50.81	90 21 02.63	59 53 19	239 52 33	Herculaneum	2,105.4
			220 13 30	40 15 20	Salt Bluff	6,658.2
			340 52 28	160 54 09	Caesars	12,107.2
Flag 14	38 12 17.12	90 19 37.30	289 57 32	110 01 39	Kidd	10,336.8
			338 43 22	158 44 10	Caesars	5,205.7
			190 48 18	10 49 10	Salt Bluff	11,882.1
Kennett's Castle	38 11 38.18	90 20 30.34	281 56 01	102 00 41	Kidd	11,250.3
			318 55 57	138 57 18	Caesars	4,841.3
			168 48 09	348 46 54	Sulphur Springs	15,180.0
Flag 16	38 08 53.40	90 14 1[illegible].90	343 03 17	163 04 09	Brickey	7,109.5
			103 27 12	283 24 40	Caesars	6,152.5
			213 51 57	33 52 44	Kidd	3,309.3
Flag 17	38 07 52.06	90 15 34.08	320 38 26	140 40 08	Brickey	6,348.5
			129 29 26	309 27 44	Caesars	5,224.5
Flag 19	38 04 08.16	90 09 05.00	110 05 22	290 03 04	Brickey	5,809.2
			207 59 29	28 00 33	County Line	5,379.6
			347 03 32	167 03 47	Magnolia	2,708.0
Flag 20	38 02 44.71	90 06 28.60	88 49 05	268 47 44	Magnolia	3 208.0
			170 02 31	350 01 58	County Line	7,434.7
			331 51 10	151 52 08	Correll	4,849.5
			250 51 32	70 53 26	Brewerville	4,766.4
Flag 21	38 01 16.02	90 04 22.07	198 16 12	18 16 48	Brewerville	4,524.2
			264 34 35	84 37 48	Reagan	7,694.2
Church spire, Saint Genevieve, Mo.	37 58 45.02	90 02 49.75	174 41 35	354 41 14	Brewerville	8,988.3
			135 34 35	315 33 18	Correll	4,357.1
			325 00 17	145 02 26	Vanse	8,900.9
Flag 23	37 58 42.73	89 57 51.48	288 11 22	108 13 28	Kaskaskia	5,260.0
			16 47 33	196 46 38	Vanse	7,545.8
Flag 24	37 58 01.51	89 58 42.45	8 55 34	188 55 10	Vanse	6,025.8
			273 23 23	93 26 00	Kaskaskia	6,252.3
Catholic church, Kaskaskia, Ill.	37 57 41.83	89 55 07.40	49 11 12	229 08 36	Vanse	8,176.2
			358 18 54	178 19 02	Rozier	10,851.1
Flag 25	37 54 51.71	89 57 56.67	223 04 06	43 06 15	Kaskaskia	7,503.1
			87 11 15	267 10 23	Vanse	2,055.9
Flag 27	37 58 55.92	89 52 51.44	37 44 48	217 43 33	Rozier	4,907.9
			265 58 54	86 01 26	Chester	6,071.0
Flag 28	37 53 16.35	89 52 06.85	56 59 13	236 57 30	Rozier	4,882.7
			251 40 40	71 42 45	Chester	5,231.9
Church spire, Chester, Ill.	37 54 55.36	89 49 21.22	89 12 55	269 06 47	Vanse	14,645.8
			54 57 45	234 54 20	Rozier	9,[illegible]45.2
			326 50 47	146 51 10	Chester	1,683.1
Flag 29	37 52 53.29	89 49 07.12	193 44 45	13 44 5[illegible]	Chester	2,423.8
			77 05 18	257 01 45	Rozier	8,707.6
Flag 31	37 50 04.48	89 42 54.76	100 32 30	280 25 08	Rozier	17,89[illegible].2
			62 19 33	242 16 46	Killion	7,543.7
			131 36 00	311 32 26	Chester	11,390.8
Flag 32	37 47 39.00	89 41 06.95	340 59 30	161 00 15	Backbone	5,551.8
			228 23 15	48 24 44	O'Harrah	4,755.8
Flag 33	37 48 07.75	89 40 07.47	222 45 54	42 46 47	O'Harrah	3,094.1
			356 43 01	176 43 10	Backbone	6,145.6
Flag 34	37 45 02.55	89 38 54.83	73 23 39	253 23 03	Backbone	1,48[illegible].4
			295 48 13	115 53 40	Fountain Bluff	14,550.1
Flag 35	37 43 12.90	89 36 30.23	120 44 34	300 44 30	Backbone	5,780.5
			287 09 25	107 15 24	Fountain Bluff	10,003.6

B2—Geographical positions of tertiary points between Keokuk, Iowa, etc.—Continued.

Station.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″		*Meters.*
Flag 36	37 44 01.70	89 35 52.46	103 51 00	283 48 33	Backbone	6,068.7
			157 14 09	337 12 25	O'Harrah	10,692.6
			297 20 43	117 24 19	Fountain Bluff	9,718.1
Flag 37	37 42 05.51	89 33 20.49	117 39 41	297 35 41	Backbone	10,852.0
			149 42 35	329 39 18	O'Harrah	15,568.5
			223 29 22	43 32 23	Worthen	10,541.0
			280 12 38	100 14 40	Fountain Bluff	4,987.1
Flag 38	37 42 56.63	89 33 07.71	298 10 08	118 12 03	Fountain Bluff	5,212.4
			109 13 57	289 09 49	Backbone	10,511.2
Simpson 211	37 44 54.95	89 39 56.76				
Upper Base	37 41 20.29	89 31 05.54	252 24 01	72 24 41	Fountain Bluff	1,680.5
			343 04 36	163 04 39	Lower Base	400.2
Lower Base	37 41 07.87	89 31 00.78	263 54 26	83 54 48	Simpson 246	884.2
			243 34 14	163 34 23	Simpson 248	1,340.1
			239 02 32	59 03 09	Fountain Bluff	1,732.2
Flag 39	37 41 10.20	89 31 14.24	214 39 03	34 39 08	Upper Base	374.9
			282 44 26	102 44 34	Lower Base	338.0
Simpson 246	37 41 10.91	89 30 24.90	106 11 41	286 11 16	Upper Base	1,036.8
			19 56 17	199 56 05	Simpson 248	1,467.1
Simpson 248	37 40 26.18	89 30 45.31	103 22 12	283 21 53	Stake 1	770.6
			34 24 50	214 24 32	Stake 2	1,289.1
Stake 1	37 40 31.96	89 31 15.91	198 30 29	18 30 38	Lower Base	1,167.6
			359 01 05	179 01 06	Stake 2	1,241.9
Stake 2	37 39 51.68	89 31 15.04	357 27 16	177 27 18	Simpson 249	1,812.2
			327 17 37	147 17 53	Stake 3	1,617.0
Simpson 250	37 39 56.09	89 30 49.19	77 53 22	257 53 06	Stake 2	648.0
			149 21 59	329 21 43	Stake 1	1,285.1
Stake 3	37 39 06.72	89 30 38.73	170 26 38	350 26 32	Simpson 250	1,543.3
			62 20 19	242 19 59	Simpson 249	914.0
Simpson 249	37 38 52.95	89 31 11.75	196 51 43	16 51 57	Simpson 250	2,023.8
			309 59 35	129 59 52	Flag 40	903.2
Flag 40	37 38 34.12	89 30 43.52	186 40 26	6 40 29	Stake 3	1,011.6
Flag 41	37 35 54.73	89 29 07.94	299 48 04	119 49 53	Big Muddy	5,069.5
			115 37 34	295 36 19	Silica	3,350.5
Flag 42	37 33 41.36	89 30 53.92	175 39 34	355 39 24	Silica	5,576.4
			257 10 08	77 13 02	Big Muddy	7,178.5
			351 38 04	171 38 22	Indian Creek	5,040.0
Flag 43	37 33 50.70	89 31 37.26	186 56 04	6 56 20	Silica	5,311.4
			260 47 27	80 50 47	Big Muddy	8,168.3
			341 10 33	161 11 18	Indian Creek	5,572.
Flag 44	37 33 07.18	89 27 28.43	216 29 47	36 30 38	Big Muddy	3,290.4
			47 38 58	227 37 11	Indian Creek	5,836.4
Flag 46	37 29 04.35	89 28 25.44	231 32 27	51 33 57	Rich	4,614.
			339 48 18	159 49 02	Moccasin Springs	5,118.
Flag 47	37 27 06.42	89 26 28.87	43 15 37	223 15 10	Moccasin Springs	1,603.
			186 34 35	6 34 53	Rich	6,548.
			291 23 50	111 27 22	Bluff Lake	9,155.
Flag 48	37 24 35.77	80 24 55.80	258 12 11	78 14 45	Bluff Lake	6,370.
			135 45 19	315 43 55	Moccasin Springs	4,854.
			339 27 13	159 28 32	Clear Creek	9,185.
Flag 49	37 24 08.97	89 26 06.11	255 01 34	75 04 50	Bluff Lake	8,244.
			327 29 16	147 31 18	Clear Creek	9,218.
Flag 52	37 20 09.04	89 27 27.21	129 43 58	309 43 20	Floral	1,994.
			226 15 44	46 19 49	Bluff Lake	13,783.

B 2—Geographical positions of tertiary points between Keokuk, Iowa, etc.—Continued.

Station.	Latitude.	Longitude.	Azimuth.	Back azimuth.	To station.	Distance.
	° ′ ″	° ′ ″	° ′ ″	° ′ ″		*Meters.*
Flag 53	37 19 42.75	89 29 46.42	344 27 03	164 28 04	Cape La Croix	9,254.8
			222 13 51	42 14 38	Floral	2,816.0
			267 35 06	87 39 21	Clear Creek	10,387.7
Normal school, Cape Girardeau, Mo.	37 18 45.14	89 31 53.17	260 40 01	80 45 33	Clear Creek	13,679.4
			321 51 57	141 54 14	Cape La Croix	9,075.9
			233 41 10	53 47 56	Bluff Lake	20,475.4
Flag 54	37 19 14.24	89 29 22.42	262 20 27	82 24 28	Clear Creek	9,875.7
			346 46 15	166 47 01	Cape La Croix	8,256.5
			332 54 24	152 56 00	Sextons	8,627.1
Flag 55	37 17 56.17	89 30 20.99	314 27 54	134 30 06	Sextons	7,527.7
			329 22 40	149 24 02	Cape La Croix	6,543.0
			128 53 12	308 52 43	Cape Girardeau	1,515.2
Flag 56	37 15 45.31	89 31 22.75	288 11 41	108 13 40	Cape La Croix	5,110.4
			280 10 41	100 13 30	Sextons	7,004.6
			183 55 05	3 55 13	Cape Girardeau	4,996.5
Flag 57	37 16 13.46	89 29 41.36	236 06 06	56 10 18	Clear Creek	12,354.0
			316 16 34	136 17 32	Cape La Croix	3,409.5
			152 22 50	332 21 57	Cape Girardeau	4,647.1
			295 35 54	115 37 42	Sextons	4,873.7
Cape Girardeau	37 18 27.01	89 31 08.86	325 33 30	145 35 21	Cape La Croix	7,979.4
			221 34 50	41 36 26	Floral	5,909.5

B 3.—*High-water marks of* 1888. *Mississippi River, Cairo, Ill., to Carrollton, La.*

Localities of high-water marks.	Bank.	Distance from Cairo, Ill.	Elevation (Cairo datum).	Distance between high-water marks.	Fall between high-water marks.	Slope per mile.	United States gauge readings.	Dates of high water.	Authorities for high waters.
		Miles.	*Feet.*	*Miles.*	*Feet.*	*Feet.*	*Feet.*		
Cairo, Ill			336.19				45.35	April 4	U. S. gauge.
Belmont, Mo	R.	21.3	328.19	21.3	8.00	.376	41.05	April 6	Do.
James Bayou, Mo	R.	44.5	319.69	23.2	8.50	.358		April 10	G. W. Harrison.
Morrison's Landing, Mo	R.	69.0	312.04	24.5	7.65	.312	36.00	April 6	U. S. gauge.
Gayoso, Mo	R.	105.7	393.76	36.7	18.28	.498		April 8	G. W. Carleton.
Osceola, Ark	R.	164.6	267.19	58.9	26.57	.453		April 11	Dr. Richardson.
Fulton, Tenn	L.	175.4	262.16	10.8	5.03	.466	33.61	April 10	U. S. gauge.
Randolph, Tenn	L.	182.6	259.11	7.2	3.05	.424		do	J. S. Bridgewater.
Memphis, Tenn	L.	230.0	238.17	47.4	20.94	.442	34.20	April 11–12	U. S. gauge.
Helena, Ark	R.	306.5	204.78	76.5	33.39	.437	42.80	April 14–15	Do.
Grant's Pass (4,000 feet below)	L.	313.0	202.58	6.5	2.20	.338		April 15	T. G. Dabney.
Friar's Point, Miss	L.	319.0	200.48	6.0	2.10	.350		April 16	Do.
Sunflower Landing, Miss	L.	352.7	186.83	33.7	13.65	.405		do	Do.
Mouth White River, Ark	R.	393.2	174.28	40.5	12.55	.310	45.55	April 20	U. S. gauge.
Riverton, Miss	L.	399.0	171.44	5.8	2.84	.490		April 22	E. T. Divver.
Niblett's Landing, Miss	L.	414.7	168.56	15.7	2.88	.183		do	R. W. McLennon.
Arkansas City, Ark	R.	438.3	161.53	23.6	7.03	.298	45.18	April 21–22	U. S. gauge.
Greenville, Miss	L.	478.5	148.55	40.2	12.98	.323	40.55	April 22–23	Do.
Lake Providence, La	R.	542.3	127.72	63.8	20.83	.326	38.10	April 24–25	Do.
Vicksburg, Miss	L.	599.3	110.22	57.0	17.50	.307	44.18	April 26	Do.
Point Pleasant, La	R.	622.2	102.40	22.9	7.82	.341		April 27	A. W. Turner.
Natchez, Miss	L.	700.4	80.23	*78.2	22.17	.284	43.40	April 27 to May 1	U. S. gauge.
Grand Cut-Off Plantation, La	R.	744.5	70.03	44.1	10.20	.231		April 29	W. L. Shaw.
Red River Landing, La	R.	765.3	65.60	20.8	4.43	.213	41.75	April 30	U. S. gauge.
Baton Rouge, La	L.	833.5	52.56	68.2	13.04	.191	32.50	April 29 to May 3	Do.
Brodé's Landing, La	R.	854.7	48.91	21.2	3.65	.172		April 29	T. H. Brodé.
Mount Airy Plantation, La	L.	915.8	39.79	61.1	9.12	.149		do	J. G. Le Bourgeois.
Carrollton, La	L.	957.0	35.61	41.2	4.18	.101	14.70	April 26	U. S. gauge.

* The distance from Point Pleasant, La., to Natchez, Miss., should really be decreased about 12.5 miles on account of the Waterproof Cut-off, and the slope per mile would then become .337 feet instead of .284 feet.

B 4.—*Extreme low-water gauge-readings, Cairo, Ill., to Carrollton, La., season of* 1887–'88.

Gauge station.	Distance from Cairo.	Elevation (Cairo datum.)	Fall between stations.	Distance between stations.	Slope per mile.	United States gauge-reading.	Dates of low-water readings.
	Miles.	*Feet.*	*Feet.*	*Miles.*	*Feet.*	*Feet.*	
Cairo, Ill	0.0	292.64	......	......	......	1.80	Jan. 1, 1888.
Belmont, Mo	21.3	288.52	4.12	21.3	.193	1.38	Jan. 1, 1888
Morrison's Landing, Mo.	69.0	276.14	12.38	47.7	.259	.10	Jan. 2, 1888.
Fulton, Tenn	175.4	230.15	45.99	106.4	.432	1.60	Jan. 3, 1888.
Memphis, Tenn	230.0	204.77	25.38	54.6	.465	.80	Jan. 4, 1888.
Helena, Ark	306.5	161.78	42.99	76.5	.562	—.20	Jan. 5, 1888.
Mouth White River, Ark	393.2	132.23	29.55	86.7	.341	3.50	Nov. 23, 1887.
Arkansas City, Ark	438.3	116.65	15.58	45.1	.345	.30	Nov. 24, 1887.
Greenville, Miss	478.5	109.85	6.80	40.2	.169	1.85	Nov. 22 to 24, 1887.
Lake Providence, La	542.3	91.14	18.71	63.8	.293	1.52	Nov. 23 and 24, 1887.
Vicksburg, Miss	599.3	62.12	29.02	57.0	.509	—3.92	Nov. 24, 1887.
Natchez, Miss	700.4	37.58	24.54	101.1	.243	.75	Nov. 24 and 25, 1887.
Red River Landing, La	765.3	24.31	13.27	64.9	.205	1.46	Nov. 25, 1887.
Baton Rouge, La	833.5	21.16	3.15	68.2	.046	1.10	Nov. 26, 1887.
Carrollton, La	957.0	20.21	.95	123.5	.008	—.70	Nov. 20, 1887.

NOTE.—The sign — placed before a reading in the above table signifies below zero of the gauge.

APPENDIX C.

Report of the shoal places in the Mississippi River between Cairo, Ill., and New Orleans, La.

Name of shoal bar.	Below Cairo.	1886.			1887.		
		Aug.	Sept.	Oct.	July.	Oct.	Nov.
	Miles.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Wolf Island	25	......	......	......	......	6½	7
Phillips	50	8	9	6	16½	6	6
Morrisons	78	6	8	8	......	7	6
J. J. Roe	78	......	......	......	15	6	6
Johns	80	......	......	......	18	8	8½
Barnells	85	9½	10½	8	16½	9	8
Sam Phillips	......	......	......	......	......	6	7½
Stewarts	95	9	......	6½	13½	8½	8½
Linwood	125	10½	......	......	21	9	8
Island No. 17	128	9½	......	......	......	8	8½
Cottonwood	130	......	......	......	......	8	9
Head Island No. 21	133	9	......	......	......	9½	10
Fletchers	160	......	......	......	18	10½	9½
Foot Island No. 30	168	10	9	7	13½	8	8
Foot of Bullerton	170	9	10½	......	15	8	8
Island No. 34	182	......	12	......	18	7	6
Head Island No. 40	225	9	9	6	15	7	7
Bradleys	228	9½	12	......	......	7	7
President's Island	255	9	......	6½	12	6	6
Horn Lake	265	9½	10½	6½	18	6½	5½
Silver Rest	268	......	......	5½	......	6½	7
Hamlans	269	......	......	......	......	8	6
Cat Island	275	9½	9	6	15	6	7
Ashley Point	300	......	......	......	......	8	7
eters	300	10½	......	......	16½	8	7
alls	315	......	......	......	12½	9	8
ip Island	320	9½	10½	6½	......	8	8
rden's Point	320	8½	......	......	13	8	9
land No. 60	330	......	......	......	......	......	10
r's Point	345	......	......	7	......	6½	6½
nds No. 67, 68	392	......	......	......	......	......	10
nd No. 69	398	......	......	......	......	......	8
mbgrass	417	......	......	......	18	6	8
ndale	428	......	......	......	......	......	9
ncice	442	......	......	......	......	......	8
ts	452	......	......	......	......	......	8
ntaw	481	......	......	......	12	7	6
and	531	9	9½	9	13½	6	6½
ing	560	......	......	......	......	......	10

Report of the shoal places in the Mississippi River, etc.—Continued.

Name of shoal bar.	Below Cairo.	1886.			1887.		
		Aug.	Sept.	Oct.	July.	Oct.	Nov.
	Miles.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Island No. 92	571	....	....	....	16½	14	9
Vista	581	....	....	....	....	....	8
Stark Island	585	9	9½	10	12	13½	8
Ajax Bar	588	....	12	10	12	12	8
Island No. 98	617	....	12	....	16½	12	10
Pawpaw	655	....	....	....	18	18	10
Young's Point	661	....	....	....	....	....	10
Services	715	....	....	....	....	15	10
Ford's Point	760	....	....	....	....	....	10
Red River	850	....	....	....	....	....	8

Gauge readings corresponding approximately with dates of soundings.

Name of gauge.	1886.			1887.		
	Aug.	Sept.	Oct.	July	Oct.	Nov.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
Cairo	10¼F	10¼F	5 F	16	4	2¾
Belmont	....	....	....	16¼	3½	2¼
Morrison's	6 F	7¼	2¼F	16½	1½	1
Fulton	9	8½	6¼F	12¾	3½	2¼
Memphis	8½	7½	5 F	11¾	3¼	1¾
Helena	10¾	10¼	6½R	16½	3½	¾
White River	15	13	9¾R	18½	6¾	4½
Arkansas City	12½	10½	6¾R	17¼	4	1½
Greenville	12	10	7 R	15½	5	2¾
Vicksburg	12 R	6¾	3¾R	15	3	0
Natchez	12½R	8¾	6¼F	19¾	5½	2½
Red River	11¾F	10½	7	19½	4½	1¼
Baton Rouge	6¼	5¾R	4 F	13¾	3¾	1¾
New Orleans	1½	2 R	1 F	....	3	....

NOTE.—F denotes falling, and R rising river. Reported by D. A. Hiner, pilot of tow-boat *Jay Gould*, Saint Louis and Mississippi Valley Transportation Company.

APPENDIX D.

REPORT OF LIEUTENANT JAMES L. LUSK, CORPS OF ENGINEERS, SECRETARY OF COMMITTEE ON CONSTRUCTION.

THE MISSISSIPPI RIVER COMMISSION,
OFFICE OF THE COMMITTEE ON CONSTRUCTION,
2653 *Olive Street, Saint Louis, Mo., May* 31, 1888.

SIR: Complying with instructions contained in your letter of the 28th ultimo, I have the honor to submit the following report upon the operations of this office for that portion of the fiscal year beginning July 1, 1887, and ending May 31, 1888:

Part of the general-service fleet and all of the survey fleet, except the steamer *Patrol*, have remained at Chester during the whole period under consideration. No damage whatever was done by ice during the past winter, which was the third consecutive one that the fleet has spent at Chester.

Nineteen of the general-service stone-barges and one store-boat were docked and repaired on account of general deterioration, and one stone-barge on account of injuries received in towing.

Under a modification of the contract of February 24, 1887, with James Mack, of Cincinnati, Ohio, six of the eleven coal-barges were completed and accepted late in the fall of 1887. There was then practically no navigation on the Ohio River, and the barges could not be got to Cairo until December 20. The *Emma Etheridge*, sent to Cairo to tow them to Chester, reached the former point just as navigation closed on the Upper Mississippi, and was unable to get back to Chester until early in March of the present year.

Requisitions for stone were received as follows: From the second district, June 20, 1887, for 8,300 cubic yards, and October 27, 1887, for 2,400 cubic yards, all to be delivered at Hopefield Bend; from the third district, August 29, 1887, 11,000 cubic yards, to be delivered at Greenville, Miss. Agreement was made with S. P. McKelvey, of Saint Louis, for supplying the first 8,300 cubic yards for Hopefield Bend, at 50 cents per cubic yard, loaded on the barges at Hop Hollow, Ill.

The river fell so rapidly that only a part of the quantity could be loaded at the locality named, and arrangements were made with the contractor to change the loading-point to Apple Creek, Mo., about 4 miles below Grand Tower; and his offer to load the 11,000 yards for Greenville and the additional 2,400 yards for Hopefield Bend was accepted at the price named, 70 cents per yard.

Bad navigation prevailed during the entire season after August 1, and it became necessary to secure a light-draught steamer for use between the quarries and Cairo. Accordingly a small boat was bought for this service, as well as to act as a tender to the fleet when laid up. She was given the name *Vedette*. Extremely low water having been supplemented about November 1 by dense smoke from forest fires over nearly all of the river between Grand Tower and Memphis, it became necessary during November to use all of the general-service steamers, as well as the *Emma Etheridge* and *Osceola*, belonging to the third district. For days together the boats could not move from the bank or could run only a few miles about midday. This state of affairs lasted through the greater part of November. The loading of stone was suspended about December 1 owing to the appearance of ice in the river.

The final cost of the stone delivered at Hopefield Bend was $1.51 cents per yard, and of that sent to Greenville, $2.38 cents per yard. The effect of the absence of competition is shown by the increase of 20 cents per yard in the price of the stone loaded during the latter part of the season. This increase is chargeable partly to legislation on the subject of convict labor, which rendered it impossible to purchase stone at Chester, and partly to low water in the Ohio River, which rendered the quarries on that stream inaccessible.

The quantity of stone delivered at Hopefield Bend during the season was 10,678 yards; at Greenville 11,104 yards; or a total of 21,782 yards.

The mileage of the steamers in moving stone was as follows, the numbers indicating piece-miles.

Minnetonka	28,388
Emma Etheridge	25,289
Osceola	7,254
Vedette	3,795
Mississippi	3,730
Total	68,456

Considering the state of navigation, the list of casualties during the season was short. One barge was lost by grounding at Silver Rest, Tenn., on October 15, 1887, and another seriously damaged. The total loss of stone in transit was 217 yards.

The mechanical draughtsman has been employed in making a survey and complete drawings of the tow-boat *Alert*, belonging to the Missouri River Commission; in preparing specifications for building a companion steamer to the tow-boat *William Stone*, also belonging to the Missouri River Commission; a complete set of specifications for building a companion steamer to the tow-boat *Minnetonka*; in designing a store-boat for the use of the general-service fleet; in studying and designing barges to replace the present plant and estimating cost of construction and maintenance of said barges, if built of wood, wood and steel, or entirely of steel; in making working drawings of a wooden-framed stone-barge; and in routine work connected with the repair and maintenance of plant.

There was available on July 1, 1887, $155,767.87; of this $45,000 was transferred by re-allottment.

Expenditures to include May 31, 1888, were $85,832.39, leaving an available balance June 1, 1888, of $24,935.48.

The expenditures for the general service incidental to moving stone are apportioned among the first, second, and third districts according to the work done for each; the general expenses of the office, and those for repairs to and care of plant, are divided equally among the first, second, and third districts.

During the period covered by this report there was one specifically authorized expenditure on account of the fourth district, which was charged directly to that district.

I present herewith a directory of the Commission, with the officers and districts under improvement; statement of value of plant May 31, 1888; detailed statement of expenditures by the general service; detailed financial statement of all expenditures from July 1, 1887, to May 31, 1888, and a general statement of appropriations and expenditures from March 3, 1881 to May 31, 1888.[*]

---

[*] Instead of the above are appended financial statements by Captain Powell, Secretary of the Commission, to June 30, 1888.

THE MISSISSIPPI RIVER COMMISSION.

Col. and Bvt. Maj. Gen. Quincy A. Gillmore, Corps of Engineers, president (to April 7, 1888).

Col. and Bvt. Brig. Gen. Cyrus B. Comstock, corps of Engineers, president (from April 7, 1888), 33 West Houston street, New York.

Lieut. Col. Charles R. Suter, Corps of Engineers, 1415 Washington avenue, Saint Louis.

Major Oswald H. Ernst, Corps of Engineers (from May 15, 1888), Galveston, Texas.

Henry Mitchell, civil engineer, office U. S. Coast and Geodetic Survey, Washington, D. C.

B. M. Harrod, civil engineer, Cotton Exchange Building, New Orleans.

Hon. Robert S. Taylor, P. O. box 1648, Fort Wayne, Ind.

S. W. Ferguson, civil engineer, Greenville, Miss.

First Lieut. Jas. L. Lusk, Corps of Engineers, secretary, 2828 Washington avenue Saint Louis.

THE COMMITTEE ON CONSTRUCTION.

Messrs. Gillmore (to April 7, 1883), Comstock, Suter, and Harrod.

First Lieut. James L. Lusk, Corps of Engineers, secretary and assistant, 265 Olive street, Saint Louis.

Officers of Corps of Engineers in charge of districts.

Districts.	Names and addresses of officers in charge.	Extent of di trict, etc.
		Miles.
Illinois River to Ohio River	Maj. A. M. Miller, custom-house, Saint Louis.	2
First district—Ohio River to foot of Island No. 40 (Plum Point Reach).	Capt. William T. Rossell, 280 Front street, Memphis, Tenn.	2
Second district—Foot of Island No. 40 to White River (Memphis Reach).	do	1
Third district—White River to Warrenton, Miss. (Lake Providence Reach).	Capt. William T. Rossell, Memphis, Tenn., and Wilson's Point, La.	2
Fourth district—Warrenton to Head of Passes.	Capt. Dan C. Kingman, 3 South Rampart street New Orleans.	4

Approximate value of plant belonging to the United States and used in the work of improvi the Mississippi River (general service).

Class of property.	Approximate value May 31, 1888.	Class of property.	Approximate val May 31, 18
Steam-boat *Mississippi*	$45,000	27 barges (flush deck)	$24,
Steam-boat *Minnetonka*	30,000	27 barges (low deck)	29,
Steam-boat *Vedette*	4,750	6 barges (open hold)	11,
1 store-boat	550	Office furniture	
2 sounding-boats	25		
1 calking-flat	20		145,

EXPENDITURES ON ACCOUNT OF APPROPRIATION FOR IMPROVING MISSISSIPPI RIV (NO LIMIT) FROM ALLOTMENT FOR GENERAL SERVICE, FROM JULY 1, 1887, JUNE 30, 1888.

Repairs to general service plant	$14,863.
Repairs to Commission survey plant	627.
Running expenses—	
Steamer *Minnetonka*	12,529.
Steamer *Mississippi*	2,722.
Steamer *Etheridge*	10,005.
Steamer *Vedette*	3,572.
Steamer *Osceola*	1,911.
Plant, tackle, and outfit	19,071.
Office rent, salaries, and contingencies	10,089.
Administration and inspection	1,652.
Care of general service plant	9,490.
Care of Commission survey plant	901.
Towing and miscellaneous	551
Total	87,988

The above expenditures were apportioned as follows:

To first district	$19,789.79
To second district	29,975.06
To third district	38,171.52
To fourth district	52.00

Financial statement, July 1, 1887, to June 30, 1888.

General service:		
Available July 1, 1887	$155,767.87	
Received from appropriation Mississippi River Commission to cover disallowed expenditure on account thereof	3,490.95	
		$159,258.82
Withdrawn for re-allotment		45,000.00
Balance		114,258.82
Expenditures apportioned		87,988.37
Balance in Treasury	$24,317.82	
Balance in hand	1,952.63	
		26,270.45
*Illinois River to Ohio River and protection of the easterly bank of the Mississippi, near Cairo:		
Available July 1, 1887		8,589.15
Balance in hand		8,589.15
Plum Point Reach:		
Available July 1, 1887	$326,307.25	
Drawn from Treasury for general service	19,789.79	
Transferred from care of plant, first and second districts	19,994.00	
		366,091.04
Withdrawn for re-allotment		337,250.00
Balance		28,841.04
Expended		26,500.41
Balance in hand		2,340.63
Hickman, Ky.:		
Available July 1, 1887 (none of which has been expended)		18,750.00
Columbus, Ky:		
Available July 1, 1887 (none of which has been expended)		18,750.00
Maintenance of existing works, first district:		
Available July 1, 1887 (none of which has been expended)		27,250.00
Care of plant, first and second districts:		
Re-allotment, act August 5, 1886	$45,000.00	
Transferred to Plum Point	19,994.00	
		25,006.00
Expended		20,890.31
Balance in Treasury	$4,006.00	
Balance in hand	109.69	
		4,115.69
Surveys first and second districts:		
Re-allotment, act August 5, 1886		10,000.00
Expended		4,190.67
Balance in Treasury	$5,500.00	
Balance in hand	309.33	
		5,809.33

---

* Includes only funds under act of July 5, 1884.

Memphis Harbor and Reach:		
Available July 1, 1887	$864.56	
Drawn from Treasury for general service	29,975.06	
		$30,839.62
Expended		30,818.07
Balance in hand		21.55
Memphis Reach:		
Available July 1, 1887		60,000.0
Expended		47,804.61
Balance in Treasury	$11,500.00	
Balance in hand	695.39	
		12,195.3
Memphis Harbor:		
Available July 1, 1887		31,012.4
Expended		14,805.5
Balance in Treasury	$13,250.00	
Balance in hand	2,956.83	
		16,206.
Lake Providence Reach:		
Available July 1, 1887	$230,695.39	
Drawn from Treasury for general service	38,171.52	
		268,866.
Withdrawn for re-allotment	197,140.00	
Transferred to care of plant and surveys	24,360.00	
		221,500.
Balance		47,366.
Expended		47,366.
Protection of existing works:		
Re-allotment, act August 5, 1886		25,000.
Balance in Treasury	$24,000.00	
Balance in hand	1,000.00	
		25,000.
Vicksburg Harbor (dredging and dam):		
Allotment, act August 5, 1886		72,500.
Expended		53,381.
Balance in hand		19,118
Delta Point:		
Available July 1, 1887	$31.90	
Re-allotment, act August 5, 1886	10,000.00	
		10,031
Expended		8
Balance in Treasury	$10,000.00	
Balance in hand	23.90	
		10,02
Greenville, Miss.:		
Available July 1, 1887		37,50
Expended		37,36
Balance in hand		13
Care of plant and surveys (third district):		
Transferred from Lake Providence Reach		24,3
Expended		15,8
Balance in Treasury	$4,860.00	
Balance in hand	3,626.67	
		8,

ew Orleans Harbor:		
Available July 1, 1887		$37,472.40
Expended		33,180.44
Balance in hand		4,291.96
outh of Red River:		
Available July 1, 1887		350.83
Expended		350.83
Red and Atchafalaya rivers:		
Available July 1, 1887	$160,371.16	
Deposit for overpayment	.10	
		160,371.26
Expended		133,147.54
Balance in Treasury	20,000.00	
Balance in hand	7,223.72	
		27,223.72
atchez and Vidalia:		
Available July 1, 1887		$825.65
Expended		75.00
Balance in hand		750.65
evees (first district):		
lum Point:		
Available July 1, 1887	13,146.34	
Transferred from levees, St. Francis Front	75,000.00	
		88,146.34
Expended		67,328.52
Balance in Treasury	15,000.00	
Balance in hand	5,817.82	
		20,817.82
t. Francis Front:		
Re-allotment, act August 5, 1886		75,000.00
Transferred to levees, Plum Point		75,000.00
evees (second district):		
azoo Front:		
Re-allotment, act August 5, 1886 (none of which has been drawn or expended)		60,000.00
hite River Front:		
Re-allotment, act August 5, 1886		75,000.00
Expended		69,456.19
Balance in Treasury	$2,500.00	
Balance in hand	3,043.81	
		5,543.81
azoo—Mississippi Delta:		
Available July 1, 1887		82.00
Expended		12.50
Balance in hand		69.50
es (third district):		
as Front:		
Available July 1, 1887	43.88	
Re-allotment, act August 5, 1886	155,083.00	
		155,126.88
xpended		152,184.60
alance in hand		2,942.28

Levees (third district)—Continued.		
Tensas Front (Ark.):		
Available July 1, 1887	$64,263.19	
Deposit for overpayment	.08	
		$64,263.
Expended		60,982.
Balance in hand		3,281.
Yazoo Front:		
Allotment expended before July 1, 1887.		
Yazoo Front—Ben Lomond Loop:		
Available July 1, 1887		1,216.
Balance in hand		1,216.
Yazoo Front—Hughes Break:		
Paid by Treasury draft before July 1, 1887.		
Opossum Fork:		
Available July 1, 1887	10,390.01	
Allotment, act August 5, 1886	56,500.00	
		66,890.
Expended		66,765.
Balance in hand		124.
Protection of levees:		
Available July 1, 1887	4,922.98	
Re-allotment, act August 5, 1886	10,057.00	
		14,979.
Expended		9,153.
Balance in Treasury	5,057.00	
Balance in hand	769.74	
		5,826.
Levees (fourth district):		
Atchafalaya Front:		
Allotment expended before July 1, 1887.		
Tensas Front:		
Available July 1, 1887	1,900.06	
Re-allotment, act August 5, 1886	165,000.00	
Drawn from Treasury for general service	52.00	
		166,952
Expended		76,672
Balance in Treasury	60,000.00	
Balance in hand	30,279.96	
		90,279
Protection of levees:		
Available July 1, 1887	6,496.18	
Re-allotment, act August 5, 1886	6,000.00	
		12,49
Expended		1,11
Balance in Treasury	6,000.00	
Balance in hand	5,385.03	
		11,38
Total available July 1, 1887 (levees)	102,461.41	
Re-allotment, act August 5, 1886	602,640.00	
Deposit for overpayment	.08	
Drawn from Treasury for general service	52.00	
		705,1
Expended		503,6
Balance in Treasury	148,557.00	
Balance in hand	52,930.66	
		201,

Consolidated statement of funds March 3, 1881, *to June* 30, 1888.

Act of March 3, 1881		$1,000,000.00
Act of August 2, 1882		4,123,000.00
Act of January 19, 1884		1,000,000.00
Act of July 5, 1884, less $5,000 transferred to snag-boat service		2,065,000.00
Act of August 5, 1886, less $5,942.60 for expenses, office Chief of Engineers		1,994,057.40
Total specific appropriations		10,182,057.40
Balances from former appropriations applied to works below Cairo under act of August 2, 1882, less $123.42, reverted to Treasury	$272,504.96	
Same for works above Cairo, under act of July 5, 1884	22,632.53	
Total balances		295,137.49
Received from sales, loss of property, and deposits		660.59
Total available		10,477,855.48
Expended to June 30, 1888:		
River works	7,597,729.01	
Levees	2,443,124.17	
		10,040,853.18
alance July 1, 1888:		
Allotted	436,815.45	
Not allotted	186.85	
		437,002.30

Detailed statement of funds, March 3, 1881 to June 30, 1888.

Districts.	From appropriations.	From balances.	From sales.	Total available.	Expended.	Balances in Treasury.	Balances in hand.	Total balances.
Des Moines Rapids to Illinois River	$195,000.00	$12,663.38	$145.14	$207,808.52	$207,808.52			
Illinois River to Ohio River	470,000.00	9,969.15	126.60	480,095.75	480,095.75			
Protection near Cairo	50,000.00			50,000.00	41,410.85		$8,589.15	$8,589.15
	520,000.00	9,969.15	126.60	530,095.75	521,506.60		8,589.15	8,589.15
Survey of St. Francis front	4,873.11			4,873.11	4,873.11			
New Madrid Reach	210,361.91		2.83	210,364.74	210,364.74			
Plum Point Reach	2,510,794.48		105.70	2,510,900.18	2,508,559.55		2,340.63	2,340.63
Hickman, Ky	18,750.00			18,750.00		$18,750.00		18,750.00
Columbus, Ky.	18,750.00			18,750.00		18,750.00		18,750.00
Maintenance of existing works	27,250.00			27,250.00		27,250.00		27,250.00
Levees: Plum Point	175,000.00			175,000.00	154,182.18	15,000.00	5,817.82	20,817.82
Totals first district	2,965,779.50		108.53	2,965,888.03	2,877,979.58	79,750.00	8,158.45	87,908.45
Survey St. Francis front	4,000.00			4,000.00	4,000.00			
Survey Helena Reach	8,000.00			8,000.00	8,000.00			
Levees: Long Lake	15,000.00			15,000.00	15,000.00			
Yazoo Front	140,950.00			140,950.00	80,950.00	60,000.00		60,000.00
White River front	75,000.00			75,000.00	69,456.19	2,500.00	3,043.81	5,543.81
Yazoo—Mississippi Delta	100,000.00			100,000.00	99,930.50		69.50	69.50
Memphis Harbor	256,750.00		22.80	256,772.80	240,565.97	13,250.00	2,956.83	16,206.83
" Reach	60,000.00			60,000.00	47,804.61	11,500.00	695.39	12,195.39
" Harbor and Reach	570,025.32		27.14	570,052.32	570,030.91		21.55	21.55
Totals second district	1,229,725.32		49.94	1,229,775.26	1,135,738.18	87,250.00	6,787.08	94,037.08
Care of plant, first and second districts	25,006.00			25,006.00	20,890.31	4,006.00	109.69	4,115.69
Surveys first and second districts	10,000.00			10,000.00	4,190.67	5,500.00	309.33	5,809.33
Survey Vicksburg Harbor	2,500.00			2,500.00	2,500.00			
Survey unleveed fronts	1,000.00			1,000.00	1,000.00			
Survey Choctaw Reach	2,679.86			2,679.86	2,679.86			
Levees: Opossum Fork	120,000.00			120,000.00	119,875.27		124.73	124.73
Yazoo Front	364,878.95			364,878.95	364,878.95			
Yazoo Front (Ben Lomond)	12,000.00			12,000.00	10,783.23		1,216.77	1,216.77
Yazoo Front (Hughes break)	6,849.69			6,849.69	6,849.69			
Tensas Front	566,723.00			566,723.00	563,780.72		2,942.28	2,942.28
	94,920.86		.08	94,920.94	91,639.92		3,281.02	3,281.02
Tensas Front (Arkansas)	28,057.00			28,057.00	22,230.26	5,057.00	769.74	5,826.74
Protection of levees	25,000.00			25,000.00		24,000.00	1,000.00	25,000.00
	37,500.00			37,500.00	37,367.05		132.95	132.95

[illegible]	[illegible]	[illegible]		[illegible] 119,502.85	[illegible] 119,506.50		10,118.64	10,118.[illegible]
Lake Providence Reach	14,000.00			14,000.00	8,976.10			
Care of plant and surveys	2,404,494.98		218.95	2,404,718.93	2,404,718.93	10,000.00	28.90	10,023.90
	21,860.00			24,860.00	15,878.33	4,860.00	3,626.17	8,486.67
Totals third district	3,963,012.92	25,770.18	219.03	3,989,002.08	3,912,848.10	48,917.00	32,236.98	76,153.98
Survey Cubitt's Gap	137.14			137.14	137.14			
Survey unleveed fronts	1,000.00			1,000.00	1,000.00			
Observations at Carrollton	3,000.00			3,000.00	3,000.00			
Bonnet Carre Crevasse	15,000.00			15,000.00	15,000.00			
Natchez and Vidalia Harbors		8,252.04		8,252.04	7,501.39		750.65	750.65
New Orleans Harbor	82,823.47	147,670.39		230,493.86	226,201.90		4,291.96	4,291.96
Mouth of Red River	38,405.00	90,812.40		129,217.40	129,217.40			
Red and Atchafalaya rivers	187,500.00		.10	187,500.10	160,276.38	20,000.00	7,223.72	27,223.72
Levees: Tensas Front	729,422.00			729,422.00	639,142.04	60,000.00	30,279.96	90,279.96
Atchafalaya Front	176,800.00			176,800.00	176,800.00			
Protection of levees	13,000.00			13,000.00	1,614.97	6,000.00	5,385.03	11,385.03
Totals fourth district	1,247,087.61	246,734.83	.10	1,493,822.54	1,359,891.22	86,000.00	47,931.32	133,931.32
General service	26,259.20		11.25	26,270.45		24,317.82	1,952.63	26,270.45
Unallotted in United States Treasury	186.85			186.85		186.85		186.85
Grand totals	10,182,057.40	295,137.49	660.59	10,477,855.48	10,040,853.18	330,927.67	106,074.63	437,002.30

Respectfully submitted

CHAS. F. POWELL,
Captain of Engineers, Secretary Committee on Construction.

APPENDIX E.

REPORT OF CAPTAIN WILLIAM T. ROSSELL, CORPS OF ENGINEERS, UPON OPERATIONS IN THE FIRST DISTRICT.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., May 31, 1888.

SIR: I have the honor to submit the following report of operations for the first dis
trict, improving Mississippi River, from June 30, 1887, to May 31, 1888.

This district was in charge of Capt. S. S. Leach, Corps of Engineers, until Marc
25, 1888, at which time I relieved him and assumed temporary charge by virtue
paragraph 1, Special Order No. 12, Headquarters Corps of Engineers, March 8, 188
The district extends from Cairo to Island No. 40, a distance of 220 miles. In th
stretch of river it was decided by the Mississippi River Commission to improve t
Plum Point Reach as the one giving the most trouble. From the inception work w
continued up to May, 1885, and consisted of bank protection and dike work. All
this work has been carefully described in the annual reports made by the Commissi
Since 1885, as appears in the annual report for 1886–'87 and this one, no work h
been done except the driving of 75 piles for the repair of the dikes at the junction
Osceola Dike No. 4, and the Osceola-Bullerton dikes, the cost as given in Capt
Leach's report, dated July 30, 1886, being $551.26, exclusive of the material on ha
and slight repairs to the Plum Point dikes, the cost of which, as given in Capt
Leach's report, dated July 25, 1887, was $7,460.77. With these exceptions the repo
have consisted in a record of the condition of the channel through the reach,
works previously constructed, and the plant belonging to the United States. T
plant, purchased or built for constructing bank protection and construction works h
as far as this district is concerned, lain idle and been a constant expense for care.
All the money spent in this district has been for the care of plant, surveys, and
building and care of levees.

The levees have been built by contract and cared for by hired labor.

In addition to these, money was appropriated by act of Congress approved Au
5, 1886, for the protection of the banks of the river at Columbus and Hickman,
$18,750 for each. Captain Leach prepared and submitted to the Commission proj
for these works, but they were laid aside by the Commission as the amounts avail
were not considered sufficient to begin work. As all the work done during the pe
covered by this report on the Plum Point Reach has been care of plant and surv
my report must of necessity give only the condition of the river and works at
present time. With this end in view I forward with this report two maps giving
results of a survey made under the direction of Captain Leach, during October
November, 1887, low water, and one made since the last high water, April and
1888. This last shows the reach as it was early in May.

CONDITION OF THE WORK.

This statement has been prepared by Assistant Engineer Aug. J. Nolty: "
damage during the year to existing works has been very light, and has been con
entirely to two isolated patches of bank revetment, one at middle of Fletcher's
and one below Elmot Landing, and to destruction by fire of part of Osceola
No. 4. The former, which upon cessation of work in 1884, was 1,481 feet long,
to show signs of damage in the spring of 1885, since which time the work of
tegration has been slowly but surely going on, until now there remains but abo
feet of badly broken up work. Placed as this piece of work was, in a badly
concave bend with unprotected and rapidly receding bank above and below it,
strong recommendation of such work that it has stood as long as it has. The
section was originally 750 feet long, and was placed to check some suddenly dev
caving, more for the protection of the plant laid up there at the time than as
tinuation of the Fletcher Bend revetment. This piece is practically destroyed.

"The Plum Point system of dikes is in excellent condition. The deposits h
creased in height and area; the bar behind No. 6, or lowest down-stream di
finally joined with Yankee Bar, showing dry there at a 17-foot stage. A small
of water still passes through the gaps closed last year, flowing along the Te
bank and through Yankee Bar Chute.

"The Gold Dust system shows no appreciable change from the appearance
sented the previous year. The training-dike and Nos. 4, 5, and 6, are badly da
and a large volume of water flows through the two gaps in the former and from
into Island No. 30 and Elmot chutes.

"On the 23d of November forest fires in the vicinity ignited the dry brush in
Osceola C. D. No. 4, and about 800 feet from the Arkansas bank out was com
destroyed. This occurred during our low-water season, and for this reason the f
could not approach within less than half a mile of the fire. Nothing could be
save the work.

"Caving has begun above the head of the upper section of Fletcher's Bend rev
and while the damage to this work is as yet so slight as to barely need mentio

in view of our experience with the middle section, a close watch will be kept over the progress of this caving. In order to save this fine piece of work it may become necessary to extend the revetment some distance up-stream.

"Osceola Bar revetment is in first-class condition. Below it the bank is caving extensively. The alarming feature about this is, that as the bank recedes, more water will be drawn from the main river into Bullerton Chute. As the same conditions prevail at the middle entrance to Osceola Chute, the early closure of Bullerton Chute appears to me of prime importance.

"Bullerton Tow-head revetment is in fair condition. The few faults now visible date as far back as 1886, and have not enlarged. The bulkheads built in front of sections of bank where extensive seepage rendered the usual method of bank protection abortive, stand perfect, and have fully answered the purpose of their construction. The same can be said of the blind drain placed to drain a badly sloughing piece of bank.

"At Ashport and at the upper end of Craighead Bend, where only foot mattresses but no upper bank protection was placed, the protective effects of these works is clearly visible."

RESULTS.

The Commission can be congratulated on the permanence of the works in this reach nd on the happy results obtained. Although the works have never been finished, er carried out fully, yet during the past year, a season of very low water, no trouble as been found in navigating this reach.

During the fall and winter of 1887-'88 the river reached its lowest recorded stage, emaining from October 10 to December 10, 1887, from 1 to 2.28 feet below the zero of 879, and from December 23, 1887, to January 5, 1888, from 1 to 3.15 feet below the ame plane. Yet the shoalest water found was 8½ feet on Island No. 30 crossing.

On the lower Plum Point Crossing the least channel depth was 12 feet at the close f the low-water season.

Caving has been most marked in bend above Daniel's Point; in Ashport Bend; in letcher's Bend; at Elmot Bar (chute side); in Craighead Bend.

Slight caving has taken place on foot of Ashport Bar; at mouth of Mill Bayou; on ennessee bank in chute of Island No. 30; at Plum Point; on channel side of Osceola r (at and below Range 47).

In Ashport Bend caving has been greatest in amount just below Ashport and just bove Gold Dust, where the maximum bank recession is 150 feet. The average yearly te in this bend is between 50 and 75 feet, a considerable increase over previous rates. he bank recession at and above Daniel's Point has been somewhat greater than 200 feet.

In Fletcher's Bend the caving has been mainly confined to the portion of bank beween Range 34 and Range 37, and its average amount is about 100 feet.

On Elmot Bar (chute side) caving has taken place at medium stages, and amounts fully 100 feet between Range 34 and Range 37.

At upper Osceola Bar the maximum bank recession is 135 feet, caused by impingeent of water from "gap in bar opposite Plum Point" during last low-water season. his "gap" has been nearly filled during higher stages, the current being across it.

In Craighead Bend caving has progressed from Range 59 to head of old levee at Craigad Point, and its average amount is less than 100 feet. At foot of Osceola Bar arly 30 feet of bank has caved since subsidence of last high water.

The changes in channel-line are confined to a slight movement of the line downeam. The high water of 1888 was above the 30-foot stage for fifteen days. The vees on right bank had been completed and repaired, preventing all overflow beeen Daniel's Point and Morgan's Point, a distance of nearly 30 miles. The disarge of main river at Elmot, of Elmot Chute, of Island No. 30 Chute, measured in gh water of 1888, shows no change in proportional discharge of these channels at h water of 1887.

The elevations of high-water surface were obtained at nearly the maximum stage. e following table gives elevations of water surface above "Cairo datum" at the eral stations; also compares high water of 1888 with that of 1887:

Station.	Bank.	High-water elevation, April 10, 1888 (Cairo datum).	Distance.	Slope per mile.	1887 above 1888.	Increased fall per mile.
						Feet.
iel's Point	Right.	272.67	....	....	0.77	....
port	Left	272.20	1.3	0.361	0.84	0.064
Dust	do	270.60	3.5	0.457	1.00	0.044
cher's (Range 32)	Right.	269.55	2.6	0.404	0.99	(—) 0.003
ot	do	268.61	2.7	0.348	1.02	0.011
n Point (Range 44)	Left	267.34	2.4	0.529	1.03	0.004
t Bullerton Chute	Right.	266.04	3.0	0.433	1.11	0.033
on*	Left	262.09	7.8	0.507	0.99	(—) 0.015

* United States gauge, 33.61 feet.

During high water of 1888 and the preceding rise the crest of bar at Daniel's Poi been lowered 3 to 5 feet; the middle bar below Range 32 almost entirely obliter the crests of middle bar below Range 42, and of Bullerton Bar lowered 2 to 3 feet crest of bar below Craighead Point raised 2 to 3 feet. A fill of 3 to 4 feet has t place in Lynch's Channel, Bullerton Channel, and Osceola-Bullerton Gap. A siderable deposit is secured in Plum Point dikes. Between Nos. 5 and 6 a fill of 2 feet is found. Below No. 6 a fill of 3 to 5 feet, and at outer end of Nos. 5 and 6 a fi 8 feet.

Soundings taken in gaps in training-wall of Gold Dust dikes indicate neither s nor fill at these points. Through Bullerton Chute no fill has occurred at its cha line, but on tow-head side deposits of mud have been obtained.

A table of depths and velocities observed on the Plum Point Reach, Novemb 1887, to June 1, 1888, is herewith.

Table showing comparative least channel-depths and velocities in various channels improved portion of Plum Point Reach, Mississippi River.

Localities.		First group.						Second group.		
		Lower Plum Point Crossing.		Bullerton Channel.		Bullerton Chute.		Island No. 30 Channel.		Lync Chan
Date.	Gauge.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Velocity.	Depth.	Veloci	Depth.
1887.	*Feet.*									
Nov. 4	—1.55	9.0	3.95	......	......	......	......	9.0	3.43	3.0
12	—1.75	9.0	3.86	......	......	......	......	9.0	4.11	......
29	—2.05	9.0	3.95	......	......	......	......	9.0	3.69	3.0
Dec. 5	—1.68	11.0	3.71	......	......	......	......	8.5	3.95	3.0
9	—0.60	12.5	3.91	......	......	......	......	10.0	3.68	......
14	2.00	14.0	4.00	......	......	......	......	12.0	3.92	......
17	1.28	13.5	3.72	......	......	......	......	11.5	3.95	5.5
21	0.40	12.5	3.95	......	......	......	......	10.5	3.65	......
29	—0.70	12.0	3.95	......	......	......	......	9.0	3.84	3.0
1888.										
Jan. 6	1.20	14.5	......	......	......	......	......	11.5	......	5.0
18	9.70 (R)	24.0	4.33	9.0	2.36	......	1.16	21.0	4.89	15.0
19	15.80	......	......	18.0	3.31	......	2.01	26.0	......	......
25	16.10	30.5	4.29	16.5	3.27	......	1.98	27.0	5.42	21.5
Feb. 29	18.60	32.5	5.80	17.5	......	......	2.55	33.0	5.64	22.5
Mar. 28	22.00	......	......	......	......	......	......	38.0	......	......
Apr. 2	28.80 (R)	......	......	26.5	3.99	......	3.57	43.5	5.31	32.0
7	31.00 (R)	44.0	4.72	28.5	3.95	......	3.76	43.5	5.43	33.0
13	30.90 (F)	43.0	4.97	28.0	4.14	......	3.57	43.5	5.61	31.5
19	29.20	41.5	5.06	28.0	......	......	3.57	42.5	5.20	31.0
25	23.30	35.5	4.75	21.0	4.11	......	3.12	35.5	5.02	24.0
27	21.00	34.0	4.37	......	......	......	......	34.5	5.37	......
May 2	16.10	28.5	4.57	......	......	......	2.29	28.5	5.45	......
7	15.00	29.0	4.51	10.5	3.87	......	2.22	27.5	5.67	13.5
11	15.06	29.0	4.36	......	......	......	2.30	28.0	5.74	......
17	16.20	30.0	4.44	11.0	3.77	......	2.44	31.0	5.44	14.0
29	20.00	34.0	4.21	15.0	4.03	......	3.23	32.0	5.33	17.5

NOTES.—The depths reported are the least found in the line of deepest water, or those which l navigation for the time being. The velocities were measured on the same line and near the sh point. They were all taken with the current-meter running at a depth of 5 feet below the su They are individual velocities, taken to ascertain the relative draught of water in the different nels and are useful for that purpose only. They have no relation to the average velocity or disc

The crossings forming Group 1 of the table may be considered as competitors for the channe Bullerton Bar. The third, Bullerton Chute, was completely closed by works; the second, Bul Channel, has remained partly obstructed by the diverting action of the works favoring the first nel, which latter has remained good by reason of carrying the water diverted from the other tw

Of the four channels in the second group, noted in previous reports, two (Elmot Chute and No. 30 Chute), have almost ceased to exist, owing to the restriction of works. Of the remainin the first, Island No. 30 Channel, has remained good and carried the bulk of the water.

A reference to the table above shows that the least depth found any time w feet, and that for a very short time on Island No. 30 crossing.

The low water of this year has been unusual, yet a good channel has been h all times through the reach.

I quote from Captain Leach's report of November 15, 1887:

"At present the load draught of boats running from Cairo down is limited to less than 5 feet by a crossing at Phillips, 50 miles below, where the most careful search with a sounding-pole has discovered no greater depth than 5 feet 2 inches. Besides this, pilots are now reporting on the 400 miles of river, comprising the two districts in my charge, the following bad places: Four of 6 feet depth, one of 6½, nine of 7, two of 7½, and five of 8 feet, making a grand total of twenty-two places in half the river where the navigable depth does not exceed 8 feet. Before the improvement was begun at Plum Point, Bullerton Bar was notoriously the worst one below Cairo, and could be depended upon to give a foot less water than any other crossing. It is conceded by all informed river men that in such a water as this no more than 4½ feet could have been found there. In its improved condition the actual depths, determined frequently and with care, have never fallen below 9 feet, thus making this place twice as deep as formerly, and better than twenty-two other places which used to exceed it in depth. This season, for the first time in the history of the work, the discharge of the river at the lowest stage was entirely through the regulated channel."

LEVEES.

At the last meeting of the Commission an allotment of $75,000 was made for "Levees, Plum Point Reach, west bank," This allotment was made in the belief that it would cover but a part of the reach, but the survey showed the quantities to be less than had been assumed, and this, with the very low prices obtained, enabled the building of new levee and enlarging and topping of old levee for a distance of 22 miles from opposite Ashport to junction with Craighead Point Levee.

The planters made good breaks in about 8 miles more, thus giving 30 miles of protection.

Proposals for the work were opened September 20, 1887, and were as follows:

Abstract of proposals for levee work on Plum Point Reach, west bank, received in response to advertisement dated August 18, 1887, and opened September 20, 1887, by Captain Smith S. Leach, Corps of Engineers.

Name of bidders.	Earth work per cubic yard on sections.																							Felling timber (per acre).	Sodding (per square yard).	Remarks.
	South.																			North.						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	1	2	3	4			
	Cts.	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*	*Cts.*			
J. S. Grant, J. K. Jeffries, and C. A. Dameron, Nebletts, Miss.	22⅛	22⅛	22⅛	22⅛	24¼	24¼	24¼	24¼	24¼	24¼	24¼	...	...	...	21½	21½	21½	21½	21½	23½	23½	23½	23½	$35	$0.01½	
J. A. Forrest and George B. Forrest, Memphis, Tenn.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18½	19⅞	20⅝	20⅞	19⅝	...	...	...	...	60	.01½	
Aylette R. Fudge, Memphis, Tenn.	21	21	20	19	17½	17½	17½	17½	17½	17½	17½	17½	17½	17½	17½	17½	20	20	19	...	...	...	...	35	.01 to .02	Others 5 to 16.
J. J. Cooney, Memphis, Tenn.	16⅞	16⅞	16⅞	16⅞	...	...	...	...	...	19	19	...	...	...	15	18	16½	16½	16½	...	...	...	...	40	.01	
William B. Strang, jr., Memphis, Tenn.	...	...	...	...	16	16	16	16	16	16	16	16	16	16	16	...	...	...	...	...	...	...	...	40	.01	
John S. McTighe and I. L. McKee, Memphis, Tenn.	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	17¾	50	.01½	
C. H. Dishman, president Central Construction Co., Henderson, Ky.	17⅜	17⅜	17⅜	17⅜	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17⅜	17⅜	17⅜	17⅜	50	.01	
Serbian, Wright & Co., Cairo, Ill.	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	15½	40	.01½	
Joseph C. Neeley, Bardwell, Ky.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	19⅞	19⅞	19⅞	19¼	60	....	
Thomas F. Duffin and Henry Duffin, Memphis, Tenn.	19	19	19	19	10	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	40	.01	
J. T. Jefferson, Memphis, Tenn.	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	19	...	...	...	...	50	.01	
Robert Johnson, Memphis, Tenn.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	40	.01¼	18 cents. Section numbers not given.
J. W. Jefferson & Co., Memphis, Tenn.	...	...	...	...	...	19	18½	18	17½	17	...	...	...	...	...	...	...	...	...	...	...	...	...	42	....	
J. E. Richards, Memphis, Tenn.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18	18	25	24	25 75	.01½	Nos. 1 and 2. Nos. 3 and 4.
George Arnold and W. O. Flynn, Memphis, Tenn.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	65	.02	21¼ cents. Section numbers not given.
John A. Cannon and T. O'Hara, Greenville, Miss.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	18	18	18	18	18	...	...	...	...	S. B. 10 H. C. 75 L. C. 35	.02	
W. E. Smith and Thomas Foley, Memphis, Tenn.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	23	23	23	23	23	...	...	...	...	S. B. 10 35	....	
Timothy Sullivan, Memphis, Tenn.	18	18	18	18	21	21	21	21	21	21	21	21	21	21	14¾	14¾	14¾	14¾	14¼	19	19	19	19	40	.03	
Reese Thomas, Memphis, Tenn.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	17½	17½	17½	17½	17½	...	...	...	...	45	.01½	
Hugh Feran, Memphis, Tenn.	...	...	...	...	24	24	24	24	24	24	...	...	...	...	...	...	...	...	...	...	...	...	...	100	.01½	Sts.
C. H. Wilson, Greenville, Miss.	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	...	....	.01	

The sections here mentioned are 5,000 feet each.

Contracts were made with Serbian, Wright & Co., of Cairo, Ill., for sections 1 to 4 north, inclusive, and 1 to 14 south, inclusive; and with Timothy Sullivan, of Memphis, Tenn., sections 15 to 19 south, inclusive, the lowest bidders.

These contracts included all work except sodding. Work was begun all along the line by October 10, 1887, and all finished before the expiration of the contracts, February 1, 1888.

The rising river brought the water against the levees on April 3, and a repair force was organized and kept on the levees through high water. The river, however, lacked a trifle more than 3 feet of extreme high water, and no danger was experienced. The repair force was utilized in sodding the levee. This work was completed and force disbanded by May 8; the sodding cost about one-fourth cent per square yard.

ADDITIONAL WORK FOR YEAR 1889-'90.

To continue the work under approved design for improving Plum Point Reach will require the closing of the channel between Elmot Bar and the Tennessee shore, requiring 4,500 feet of dike work.

The revetment of Fletcher's Bend and the lower part of Osceola Bar. To do this work will require additional plant and extensive repairs to present plant.

The estimated cost of this is as follows:

Dike between Elmot Bar and Tennessee shore, 4,500 feet, at $40	$180,000
Revetment Fletcher's Bend, 12,000 feet, at $20	240,000
Revetment Lower Osceola Bar, 4,000 feet, at $20	80,000
Repairs and addition to plant	150,000
Total	650,000

No estimate is made on levees, first district, as the amount that can be profitably expended is only limited by the amount available.

There are submitted herewith financial statements and general balance-sheet for the allotments in the first district; a list of civilian engineers employed in the first and second districts; a table of the value of plant first district; general balance-sheet for "care of plant, first and second districts," and "surveys first and second districts."

Very respectfully, your obedient servant,

Wm. T. Rossell,
Captain of Engineers.

To Col. C. B. Comstock,
President Mississippi River Commission.

APPROPRIATION FOR IMPROVING MISSISSIPPI RIVER, FIRST DISTRICT.

Money statement.

July 1, 1887, amount available		$376,947.59
July 2, 1887, amount re-allotted by Mississippi River Commission, viz:		
Protection of existing works, first district	$27,250.00	
Levees, Plum Point Reach, west bank	75,000.00	
Received from allotment for "care of plant, first and second districts," to cover expenditures from October 1, 1886, to June 30, 1887	19,994.00	
Overpayment refunded	6.00	
		122,250.00
Total		499,197.59
July 1, 1888, amount expended during fiscal year, exclusive of outstanding liabilities	74,039.14	
July 1, 1888, outstanding liabilities	1,599.77	
July 2, 1887, amount re-allotted by Mississippi River Commission	337,250.00	
July 1, 1888, amount covered by existing contracts		412,888.91
		86,308.68
Amount that can be profitably expended in the fiscal year ending June 30, 1890 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		650,000.00

List of civilian engineers employed on work of river and harbor improvement, first and secon districts, in charge of Capts. Smith S. Leach and William T. Rossell, Corps of Engineer from July 1, 1887, to June 30, 1888, inclusive, under river and harbor act approv August 5, 1886.

Name and place of residence.	Time employed (months).		Compensation per month.	Where employed.	Work on which employed
	M.	*d.*			
Aug. J. Nolty, Chattanooga, Tenn.	11	5	$125	Plum Point Reach ..	Improving Mississip River, Plum Point Reac
Charles W. Stewart, Illinois.	12		100	....do	Surveys.
S. Elliott Moore, Memphis, Tenn.	12		140	....do	Levee inspector, Plum Poi Reach.
W. M. Rees, Memphis, Tenn.	1		150	....	Improving Mississip River.
	11		175	Memphis, Tenn	Memphis Harbor and Reac
J. M. Kloster, Memphis, Tenn.	10	27	140	White River Front, Robinsonville, Miss.	Levee inspector White Riv front, Robinsonvil Levee.
Kivas Tully, Saint Louis, Mo.		28	125	Saint Louis, Mo.....	Inspector rebuilding steam *Abbot.*
C. W. Clark, Saint Louis, Mo.	4	10	125	In the field	Inspector of water-gauges.

Approximate value of plant belonging to the United States and used upon the improvem of the Mississippi River, first district.

Class of property.	No.	Approximate value, June 1, 1888.	Class of property.	No.	Approximat value, Ju 1, 1888.
Steamer *P. Kirns*	1	$4, 298	Barges	50	[illegible]
Steamer *Itasca*................	1	4, 624	Machine-shop boats	1	2,
Steamer *Abbot*................	1	3, 692	Whitehall boats................	4	
Launch *Titania*	1	576	Skiffs............................	60	
Pile-drivers	37	67, 687	Tools and appliances..........	....	5,
Quarter-boats	14	15, 339	Office furniture...............	....	
Mattress boats.................	10	14, 490	Surveying instruments........	....	
Graders	2	20, 165			
Derrick boats..................	2	3, 127	Total..........................	....	[illegible]

Wm. T. Rossell,
Captain of Engineer

APPENDIX F.

REPORT OF CAPTAIN WILLIAM T. ROSSELL, CORPS OF ENGINEERS, UPON OPERATION THE SECOND DISTRICT.

United States Engineer Office,
Memphis, Tenn., May 31, 18

Sir: I have the honor to submit the following report on the second district, proving the Mississippi River, for the period from June 30, 1887, to May 31, 1888.

This district was in charge of Capt. S. S. Leach until March 25, 1888, on w date I relieved him by virtue of paragraph 1, Special Orders No. 12, headqua Corps of Engineers, March 8, 1888.

This district extends from Island No. 40 to mouth of White River, a distan 180 miles. Work, exclusive of building levees, has been confined to Memphis Ha and Reach. At this point the city front was caving badly, and afterward the ca

on the opposite shore at Hopefield Point and above threatened to form a bar in fron of the city.

Although the Memphis Reach extends from Island No. 40, 10 miles above Memphis, to Scanlan's Landing, 18 miles below, the work above mentioned is all that has been done.

The channel works have been exclusively for the protection of caving banks and have been both revetment and spur-dikes. A fine description of all this work is given in the report of Captain Leach to the president of the Mississippi River Commission, dated November 15, 1887, and published in House Ex. Doc. 55, parts I and II, Fiftieth Congress, first session. As this report is of great interest I would suggest that it be made a part of the annual report of the commission.

The work done during the past year on the Memphis City Front has made the line of protection complete from above the mouth of Wolf River to the down-stream end of the citizens' protection work. It seems superfluous for me to say anything regarding this construction, as the details have already been given by Captain Leach.

It only remains for me to say that no damage was done by the high water just passed, and although I have not yet been able to get a survey since the high water, I can say that the bank has been perfectly protected.

At Hopefield Bend the revetment was extended 4,000 feet below the old work of 1884. Upon commencing operations in the fall of 1887 it was found that 1,400 feet of the work of 1884 was lost. This was caused by caving at the lower end. In addition, a small break in the 1884 work was repaired, equal to 105 linear feet, making a total of 4,105 linear feet, with a width of 335 feet. This is from 50 to 75 feet wider than work previously done in this bend.

The usual methods were followed in building the subaqueous mats and the bank protection, except that for a portion of the upper bank protection, the brush in two layers was laid diagonally on the ground, the two layers being at right angles to each other. I am of the opinion that this is an improvement over laying the brush parallel and perpendicular to the banks. The bank caved badly during and subsequent to the past high water, where not revetted, the caving at Hopefield Point being 375 feet; at head of Old Hen Island about 150 feet, and at Fort Pickering, below the protection works, about 75 feet.

It will be necessary to continue the protection down to and beyond Hopefield Point, and at Memphis the work must extend 6,000 feet further down.

A comparison of the present protected bank at Hopefield Bend, with bank line of 1882, shows that 2,500 feet below the head of the revetment is on bank line of 1882; 6,500 feet below the head of the revetment the caving is 400 feet; 8,700 feet below is 1,100 feet, and 12,000 feet below is 2,400 feet.

At Hopefield Point the caving is 3,000 feet, and the point has moved down-stream 4,200 feet since August, 1882. The total caving at Fort Pickering since 1882 has been 200 feet.

LEVEES.

Yazoo Front.—No work has been done since the last annual report. During the past high water the line was cared for by the Yazoo-Mississippi Levee Board, and no damage was done. The Robinsonville Levee, for which the Commission allotted $60,000 at its last meeting, conditioned on the levee board completing the line, has not yet been begun. On May 31, however, the levee board decided to advertise the work, and application was made to enter into contract with whoever might get their contract for the Government work.

White River Front.—Under the allotment of $75,000, made by the Mississippi River Commission at their last meeting, contracts were made for building this line for a distance of 6¾ miles. This line, added to the part built by the local authorities, completed 14¼ miles of levee from Helena, Ark., south. The line followed was that of the old levee, with loops at breaks. The grade of this line is 2 feet above the high water of 1886—the highest in this section.

The following is an abstract of bids received:

Abstract of proposals for levee work on levees, White River Front, received in response to advertisement dated October 8, 1887, and opened October 27, 1887, by Capt. Smith Leach, Corps of Engineers, U. S. Army.

Bidders.	Earth-work per cubic yard on Section No.— 8	9	10	11	12	13	14	15	16	17	18	Felling timber (per acre).	
J. A. Forrest, Memphis, Tenn	....	....	15½	15½	15	....	....	....	....	....	....	$25	....
Hugh Feran, Memphis, Tenn	....	19½	19½	....	....	....	....	....	....	....	....	40	[illegible]
Daniel T. Hartnett, Memphis, Tenn	15	14¾	14¾	15	15	....	..	....	....	....	....	29	1
Fruin-Bambric Construction Company, Saint Louis, Mo	....	20¼	20¼	20½	20¼	20¼	20¼	20¼	20½	20¼	20¼	45	1
J. J. Cooney, Memphis, Tenn	16½	15⅝	15⅝	16	16⅞	16⅞	19	19	18	18	20	40	1
Joshua T. Jefferson, Memphis, Tenn	....	16	16	16	16	16	....	..	....	....	....	40	1
A. A. Arnold and C. F. De Garis, Memphis, Tenn	....	17	17	19	17	19	28	28	23	23	20	65	1½
McTighe & Co., Memphis, Tenn	16	15½	15½	15½	15½	17	22	22	18	18	20	36	1
Central Construction Company, Henderson, Ky	....	16	16	17	18	20	....	....	....	....	....	40	½
A. McDowell, Memphis, Tenn	....	....	....	....	....	16¼	26½	23½	23	21	....	60	1
Harvey & Sullivan, Memphis, Tenn	....	16	16	16	16	16	....	....	....	....	....	35	½
J. K. Jefferies, J. S. Grant, and C. A. Dameron, Nebletts Miss	15¾	15¾	16¾	16¾	17½	17½	....	....	....	....	....	15	1
T. W. Scott, Memphis, Tenn	....	18½	18½	18½	18½	18½	....	....	....	....	....	40	1
A. M. Stover, Memphis, Tenn	....	16	....	....	....	....	....	....	....	....	....	....	1

The award was made to the lowest bidder on each section, as follows:

Sections 8, 11, and 12 to D. T. Hartnett, at 15 cents.

Sections 9 and 10 to D. T. Hartnett, at 14¾ cents.

Section 13 to J. T. Jefferson, at 16 cents.

Sections 14 and 15 to J. J. Cooney, at 19 cents.

The average price for the line is 16¼ cents.

The contracts required work to be finished February 15, 1888, but owing to bad weather the contractors were delayed until March 10; the total yardage by the United States was 376,551 cubic yards.

During the high water a force was kept on the line in view of possible danger. Some work was done, but the height of the flood was low and the force was principally utilized in sodding and repairing rain wash. The cost of sodding was about one-half cent per square yard. The force was discharged May 21, 1888.

ESTIMATE OF WORK NEEDED.

Memphis Harbor.—If work is to be extended down-stream—

To include caving front, 6,000 feet, at $30	$180,000
Hopefield Bend, 5,000 feet, at $18	90,000
New plant and repairs to old	50,000
Total	320,000

Levees.—To continue levees White River Front to Laconia Circle, 1,500,000 (approximate) cubic yards, at 20 cents, $300,000. Detailed statement of expenditures for Memphis Reach, financial statements and general balance-sheets for all works in the district, and table of value of plant for the second district accompany this report. For list of civilian engineers employed see table accompanying my report for the first district.

Very respectfully, your obedient servant,

Wm. T. Rossell,
Captain of Engineers.

To Col. C. B. Comstock,
President Mississippi River Commission.

Statement of expenses for work done in Hopefield Bend from September 1, 1887, to January 31, 1888.

Items.	Administration.	Care of plant and materials.		General repairs.		Tow-boat service.		Subaqueous mattresses.		Bank revetment.							Grand total.		Per cent. of cost.
										Clearing.	Grading.		Mattressing.		Total.				
	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	Amt.	Cost.	
Labor	$1,234.00		$1,936.93		$1,312.04		$2,275.18		$5,491.96	$202.00		$1,586.40		$6,304.82		$8,092.72		$20,842.82	33.42
Subsistence, services	47.16		103.64		48.15		273.83		432.39	34.08		70.80		508.64		613.52		1,518.69	2.49
Subsistence, stores	101.78		397.25		137.71		585.54		1,809.41	108.57		232.31		1,958.34		2,294.22		5,325.91	8.75
Brush ... cords								3,752	4,314.80				5,470	6,521.94	5,470	6,521.94	9,222	10,836.74	17.80
Poles ... do								833	1,457.75				603	1,031.65	603	1,031.65	1,436	2,489.40	4.09
Stone ... cubic yards								3,821	5,784.96				4,032	6,103.42	4,032	6,103.42	7,853	11,888.88	19.52
Wire ... pounds								39,708	1,588.32				34,678	1,387.12	34,678	1,387.12	74,388	2,975.44	4.88
Wire strands ... do								11,530	547.67				1,450	68.88	1,450	68.88	12,980	616.55	1.01
Spikes and nails ... do				700	16.60	200	4.80	6,900	205.45				2,400	73.20	2,400	73.20	10,200	300.05	.49
Lumber ... feet				1,538	28.44	3,682	126.89	3,100	62.00								8,320	217.33	.35
Coal ... boxes		809	258.20	878½	266.70	5,830	1,928.38				2,103	787.20			2,103	787.20	9,620½	3,240.48	5.32
Iron ... pounds				830	8.35	38	.95	1,130	29.75		386	9.54	529	13.23	915	22.77	2,413	61.82	.10
Manila rope ... do								1,200	135.00								1,200	135.00	.22
Tug hire			75.00				50.00											125.00	.20
Miscellaneous	5.70		151.30		269.23		245.52		24.28			102.59		23.20		125.79		821.82	1.35
Totals	1,368.64		2,922.32		2,087.22		5,491.09		21,883.73	339.65		2,788.84		23,993.94		27,122.43		60,895.43	
Percentage of cost	2.28		4.80		3.43		9.02		35.94	0.56		4.57		39.40		44.53			100.00
Work done								7,761 squares made. 7,546 squares covered.		4,100 linear feet. 6 acres	4,276 linear feet. 50,172 cubic yards.		7,143 squares made. 6,182 squares covered.				4,105 linear feet × 835 + average width = 13,728 squares covered.		
Cost per unit								$2.82 per square made. $2.843 per square covered.		8.8 cts. per lin. foot. $56.61 per acre.	65.22 cents per linear foot. 5.56 cents per cubic yard.		$3.86 per square made. $3.88 per square covered.		$4.89 per square of bank covered.		$14.83+ per linear foot. $4.44— per square covered.		

WM. T. ROSSELL,
Captain of Engineers.

APPROPRIATION FOR IMPROVING MISSISSIPPI RIVER, SECOND DISTRICT.

Money statement.

July 1, 1887, amount available		$91,958.97
July 2, 1887, amounts reallotted by Mississippi River Commission, viz:		
Levees, White River Front	$75,000.00	
Levees, Yazoo Front, Second district, Robinsonville	60,000.00	
		135,000.0
Total		226,958.9
July 1, 1888, amount expended during fiscal year, exclusive of outstanding liabilities	132,921.89	
July 1, 1888, outstanding liabilities	278.57	
July 1, 1888, amount covered by existing contracts	57,000.00	
		190,200.4
July 1, 1888, balance available		36,758.5
Amount that can be profitably expended in fiscal year ending June 30, 1890 } Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		620,000.0

General balance sheet.

MEMPHIS HARBOR.

Dr.					Cr.
1887. June 30	To balance	$31,012.41	1888. June 30	By amount expended from July 1, 1887, to date	$14,805.
			June 30	By liabilities	76.
			June 30	By balance	16,130.
		31,012.41			31,012.

MEMPHIS REACH.

1887. June 30	To balance	$60,000.00	1888. June 30	By amount expended from July 1, 1887, to date	$47,804
			June 30	By liabilities	132
			June 30	By balance	12,06
		60,000.00			60,000

MEMPHIS HARBOR AND REACH.

1887. June 30	To balance	$864.56	1888. June 30	By amount expended from July 1, 1887, to date	[illegible]
				By balance	[illegible]
		864.56			[illegible]

LEVEES, YAZOO-MISSISSIPPI DELTA LEVEE DISTRICT, UPPER YAZOO.

1887. June 30	To balance	$82.00	1888. June 30	By amount expended from July 1, 1887, to date	[illegible]
				By balance	[illegible]
		82.00			[illegible]

YAZOO FRONT, ROBINSONVILLE.

1887. July 2	To amount allotted	$60,000.00	1888. June 30	By liabilities	$57,
			June 30	By balance	2,
		60,000.00			60,

General balance sheet—Continued.

LEVEES, WHITE RIVER FRONT.

DR.			CR.		
1887. July 2	To amount allotted	$75,000.00	1888. June 30	By amount expended from July 2, 1887, to date	$69,456.19
				By balance	5,543.81
		75,000.00			75,000.00

SECOND DISTRICT.

Disbursements made under appropriation for improving Mississippi River, act of August 5, 1886.

[November 1, 1887, to June 30, 1888.]

Contracts made with—	For what made.	Disbursements under contract.	Liabilities under contract.	Total.
C. W. Hunter & Co	Brush and poles.	$5,280.30		$5,280.30
Holmes & Stockley	do	6,272.18		6,272.18
Daniel T. Hartnett	Levee work	33,428.72		33,428.72
J. T. Jefferson	do	7,849.98		7,849.98
J. J. Cooney	do	21,190.12		21,190.12
W. O. Flynn & Co	do		$57,000.00	57,000.00
		74,021.30	57,000.00	131,021.30

Disbursements made otherwise than under contract.

For what expended.	By public notice and sealed proposals.	In open market.	Liabilities.	Total.
aterial and supplies	$4,356.16	$3,742.11		$8,098.27
ubsistence	4,127.70	643.42		4,771.12
ervices		23,685.34	$132.50	23,817.84
iscellaneous	40.52	1,484.60	146.07	1,671.19
	8,524.38	29,555.47	278.57	38,358.42

pproximate value of plant belonging to the United States and used upon the improvement of the Mississippi River, Second District.

Class of property.	No.	Approximate value June 1, 1888.	Class of property.	No.	Approximate value June 1, 1888.
eamer *H. M. Graham*	1	$3,341	Skiffs	14	$95
aunch *Daphne*	1	886	Pile drivers	9	15,218
at-boats	3	477	Coal shells	..	212
attress boats	2	4,307	Tools and appliances	..	2,800
achine-shop boat	1	3,179	Office furniture	..	250
reen boats	4	2,120	Surveying instruments	....	125
uarter boats	5	4,202			
arges	23	15,678	Total		52,890

Appendix G to this report is report of Capt. S. S. Leach, Corps of Engineers, dated emphis, Tenn., November 15, 1887, upon operations in the Second District, and may e found in Appendix U U 1, *ante*, page 2203.

APPENDIX H.

REPORT OF CAPTAIN WILLIAM T. ROSSELL, CORPS OF ENGINEERS, UPON OPERATIONS IN THE THIRD DISTRICT.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., May 31, 1888.

SIR: I have the honor to submit the following report of operations in the Third District, Improving Mississippi River, from June 30, 1887, to May 31, 1888.

This district extends from the mouth of White River to Warrenton, Miss., a distance of 220 miles. In the improvement carried on, work has been done in the Lake Providence Reach, at Vicksburg and Greenville, Miss.

Levees have also been built on the Mississippi side, Yazoo Front, and in Arkansas, and Louisiana, Tensas Front.

LAKE PROVIDENCE REACH.

This reach extends from Carolina Landing, 517 miles below Cairo, to the foot of Island 95, a distance of 35 miles. The reach and proposed method of improvement have been described in the reports of the Commission for past years. During the period covered by this report no work of construction has been done, but the work has been confined to care of plant and repairs to same, and surveys.

The same condition of affairs has existed since the spring of 1885, except some repairs to the Baleshed system of dikes made at a cost of less than $10,000.

Condition of works.—The revetment and dike work are in about the same condition as last year. There has been no washing out of dikes. The damage done has been confined to the breaking off of the tops of the piles by drift during the last high water.

The Cottonwood, Baleshed and Stack island systems have all suffered in this manner. The cottonwood piles rot between high and low water, and when they are sufficiently weakened, break down. Skipwith Chute is about the same as last year, going dry at low water.

Mayersville Chute has increased in depth and the dikes here have not prevented it. The channel here divides, part keeping near the Louisiana shore and part on Mississippi shore, leaving a middle ground between. Baleshed Chute shows no signs of enlargement, and Stack Island Chute has shoaled.

As reported last year, about 800 feet of the upper end of Pilcher's Point revetment remains, and none of Mayersville Island.

Channel depths.—A comparison of the least depths found during the low-water seasons 1884, 1885, 1886, 1887, and to May 31, 1888, is given in tabulated form.

Statement showing least depths on Lake Providence Reach, 1884, 1885, 1886, 1887, *and* 1888.

Date.	1884.			1885.				1886.				
	L. P. gauge reading.	Stack Island Crossing.	Ben Lomond Crossing.	L. P. gauge reading.	Duncansby Crossing.	Stack Island Crossing.	Ben Lomond Crossing.	L. P. gauge reading.	Duncansby Crossing.	Wilderness Crossing.	Stack Island Crossing.	Ben Lomond Crossing.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
January 10	30	......	......	29.4	......	40	39	17.2	27	......	24	24
January 20	25.4	......	......	33.6	......	46	43	22.5	32	......	31	27
January 30	25.5	......	......	34.6	......	44	42	21.5	31	....	29	32
February 10	30	.....	......	31.4	......	39	38.5	20.5	27	......	27	24.5
February 20	36.8	......	......	27.1	......	33	33	27.5	35	......	33	27.5
February 28	37.7	......	......	21.2	......	14.5	26.5	31.7	38	......	32	31.7
March 10	38.1	......	......	18.6	......	23.5	26	32	42	......	29	33
March 20	38.1	......	......	27.1	......	......	......	25	30	......	27	34
March 30	37.8	......	......	27	......	......	......	22.5	33	......	27	35
April 10	36.6	......	......	22	......	......	......	32.2	40	......	36	32.5
April 20	36.8	......	......	28.1	......	......	......	35.5	41	......	39	35.5
April 30	36.5	......	......	32.2	......	......	......	37.5	43	......	38	35.7
May 10	36.5	......	......	35.5	......	......	......	37.5	45	......	40	43
May 20	35.9	......	......	29.4	......	......	......	35.5	43	......	38	44
May 30	32.5	......	......	22.9	......	......	......	35.2	39	......	37	42
June 10	24.6	......	......	25	31.5	24	33.5	27	31	......	28	32
June 20	23.3	......	......	24.5	31	21	29.5	21	28	......	21	29
June 30	25.7	......	......	28	35	22.6	29.5	23	32	......	25	32

Statement showing least depths on Lake Providence Reach, etc.—Continued.

Date.	1884.			1884.				1886.				
	L. P. gauge reading.	Stack Island Crossing.	Ben Lomond Crossing.	L. P. gauge reading.	Duncansby Crossing.	Stack Island Crossing.	Ben Lomond Crossing.	L. P. gauge reading.	Duncansby Crossing.	Wilderness Crossing.	Stack Island Crossing.	Ben Lomond Crossing.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
July 10	21.1	......	......	24.7	31.4	20	24	24.5	28	......	24	31
July 20	19.6	......	......	22	29	17	26	17	22	......	16	21
July 30	15.8	......	......	15.5	20	14	18.5	12	18	......	11	16
August 10	15.5	18	24	14	19	14	21	10	15	......	11	15
August 20	12.6	14	12	15.6	36	15	28	8	16	......	10	12
August 30	8.9	10	14	12.2	30	15	29	7.8	18	......	11	15
September 10	9.1	14	17	13.4	32	16	30	6.6	16	......	9.5	15
September 20	6.6	17	11	18	35	19	25	5.3	15	14	9	12.5
September 30	5.8	15	11	15.5	30	23	20	4.7	13	12	8.5	11.5
October 10	14.8	24.5	15	9	22	14	15	5	14.5	12	9	12
October 20	13.7	26	24	7.1	18	14	13	......	......	......	......	......
October 30	12	24.75	22.5	8	18	15	14	2	10.5	12	11	10
November 10	11.1	23	26	10.7	20	16	15	2.8	11	10.5	11	11
November 20	7.2	21	17	19.2	34	28	26	2.	10.5	9.5	12.5	9.5
November 30	6.6	19	16	13.5	23	19	19	12.2	23.5	18.5	19.5	18
December 10	7.8	20	18	10.5	21	18	18	15.7	26	24	20	20
December 20	11	23.5	19	12	22	21	19	6.3	21	12.5	11	12
December 30	12	21	20	16.5	25	24	24	14.6	32	34.5	21	17

Date.	1887.					1888.				
	L. P. gauge reading.	Duncansby Crossing.	Wilderness Crossing.	Stack Island Crossing.	Ben Lomond Crossing.	L. P. gauge reading.	Duncansby Crossing.	Wilderness Crossing.	Stack Island Crossing.	Ben Lomond Crossing.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
January 10	13.7	20	21	19	15	4.25	21	18.5	14	15.5
January 20	7.8	17	18	15	10	18.75	31	31	26	27
January 30	14.8	29	28	24	21	20.25	26	39	35	30
February 10	28.7	40	43	37	36	16.75	26	28	23	26
February 20	32.7	52	41	42	40	18.5	34	29	35	31
February 28	35.7	50	38	43	35	20.5	30.5	34	29	31.5
March 10	36.2	53	40	45	43	24.5	36	36	32.5	37
March 20	......	......	......	......	......	22	36	33	32	35
March 30	37.8	50	40	43	41	23.75	37	36	31.5	36
April 10	33	40	26	35	20	34	41.5	39	42	34
April 20	23	29	20	25	26	37.75	51.5	45	49	37.75
April 30	24	31	33	24	23	37	48	42.5	39.5	37
May 10	31.5	37	33	35	39	28.25	40	32.5	33.5	34.5
May 20	29	34	29	31	35	22.5	34.5	28.	27	31
May 30	21	28	21	21	25	27.25	37	34	31.5	35
June 10	14.5	22	18	17	20	......	......	......	......	......
June 20	16.5	23	21	19	23	......	......	......	......	......
June 30	17	23	21	19	23	......	......	......	......	......
July 10	14	18	17	16	20	......	......	......	......	......
July 20	12.5	21	18	15	21	......	......	......	......	......
July 30	9.25	15	13	12	17	......	......	......	......	......
August 10	......	......	......	......	......	......	......	......	......	......
August 20	7.75	12	14	13.5	15	......	......	......	......	......
August 30	5	11	12	8.5	11	......	......	......	......	......
September 10	4.5	11	12	7	12	......	......	......	......	......
September 20	4.75	18	14	9.9	14	......	......	......	......	......
September 30	6.4	15.6	16	11	14	......	......	......	......	......
October 10	4.25	12	15	11	16	......	......	......	......	......
October 20	4.25	15	14.5	10.9	16.5	......	......	......	......	......
October 30	2.5	12	14	9	12	......	......	......	......	......
November 10	2.25	11	13	9	13	......	......	......	......	......
November 20	1.75	12	12	9	13	......	......	......	......	......
November 30	1.75	12.5	12	9.8	13	......	......	......	......	......
December 10	4	15.4	16	12	14.2	......	......	......	......	......
December 20	6.75	16.8	20.5	15	18.2	......	......	......	......	......
December 30	......	......	......	......	......	......	......	......	......	......

The least depths were as follows:

Duncansby Crossing.—1885, 18 feet; 1886, 10½ feet; 1887, 11 feet.

Wilderness.—1886, 9½ feet; 1887, 12 feet.

Stack Island.—1884, 10 feet; 1885, 14 feet; 1886, 8½ feet; 1887, 7 feet.

Ben Lomond.—1884, 11 feet; 1885, 13 feet; 1886, 9½ feet; 1887, 11 feet.

The lowest reading of the Lake Providence gauge was, in 1884, 5.23 feet; 1885, 5.54 feet; 1886, 2.55 feet; 1887, 1.52 feet.

CHANGES IN CHANNEL AND SHORE-LINES.

The high water this year was late, and as this report was required earlier than usual, the survey to show changes of the high water was not entirely finished. The map accompanying this report, however, shows the shore-lines in 1882, 1887, and 1888, also the position and condition of the dike work. The banks of the river through the Lake Providence Reach have been more unstable during the past year than in any of the seven immediately preceding. This is due in a great measure to changes that have taken place in the channel above the reach and to the loss of the Pilcher's Point revetment, which occurred during the high water of 1886-'87.

The continued caving along the upper side of Sarah's Island, caused by changes above, has thrown the current with great force against the lower part of Louisiana bend (where the Pilcher's Point revetment was designed to be); this has caved extensively, being unprotected. Then, by the deepening of this bend, the channel has been deflected back, striking the Mississippi side about 3½ miles above Duncansby. It then follows this bank for about 2½ miles, caving the bank. Here it is again deflected to the Louisiana shore about a mile below Possum's Point, and keeps along it to Wilson's Point. Caving has taken place here to a small extent. The main current here divides, one part striking the Mississippi shore just above Mayersville and flowing along the front of Mayersville Island. The other channel keeps along near the Louisiana bank, and passes just outside the Cottonwood dikes. Mayersville Island has nearly disappeared, and will probably be gone after the next high water. The two channels come together immediately below the foot of Mayersville Island The channel then flows along the Louisiana shore, caving the bank badly between Longwood and Allright. The current then crosses just below Ben Lomond to the Mississippi side, and caving occurs here.

The cutting away of the upper side of Shipland Point has caused the crossing from here to the Louisiana bank to move further down stream and allowed a larger volume of water to pass around the point next to Mississippi shore. The caving at Wyly's has not been as great as in former years. Below Shipland Landing on the Mississippi side considerable caving has taken place.

Tables showing the extent of caving from Ashton La., to Shipland, Miss., from April, 1887, *to May,* 1888.

RIGHT BANK.

Locality.	Length.	Maximum depth.	Average depth.	Acres.
	Feet.	*Feet.*	*Feet.*	
Louisiana Bend	20,000	680	250	114.7
Possum Point to Wilson's Point	5,000	130	80	9.1
Longwood to Allright	20,000	500	185	84.9
Deesona to Wyly's	7,400	700	257	43.4
Total	52,400			252.1

LEFT BANK.

Locality.	Length.	Maximum depth.	Average depth.	Acres.
Bend above Duncansby	13,500	310	137	42.4
Above Mayersville	2,600	200	90	5.4
Mayersville Island	8,000	1,680	900	165.3
Ben Lomond to Shipland	9,000	890	425	87.8
Below Shipland	4,500	290	182	18.8
Total	37,600			319.7

REPAIRS TO PLANT.

The floating plant was repaired and put in serviceable condition in the fall of 1886 and winter of 1887. Since that time only small and absolutely necessary repairs have

been made. A portion of the plant, used at Greenville and Vicksburg, Miss., was repaired and the rest has remained tied to the bank at Wilson's Point, where it has already been subjected to the deteriorating effect of one summer. It will need extensive repairs to again put the plant in condition for active service. The greater part of the plant is over seven years old, and this class of boats and barges requires at this age extensive annual repairs to keep it in working condition. The effect of the climate is worse on idle boats than on those in use. It is estimated to put this plant in working order will cost about $20,000. To carry on bank protection work at four different places will require a large addition to plant, estimated to cost $200,000. I have assumed four places, as follows: Greenville, Pilcher's, Delta Point, and Lake Bolivar.

Statement showing the cost of labor and subsistence for care of fleet and minor repairs to same.

Classification.	Pay-roll.	Subsistence.	Total.
Care of fleet and minor repairs	$15,653.50	$2,693.51	$18,347.01

The largest number of men employed at any one time was 39; the smallest, 22.

AVERAGE COST OF SUBSISTENCE.

	Cents.
Cost of raw material, each ration	26.1
Cost of each ration served	36.2
Cost of rations for each day's labor	37.7

To make good losses and carry out the approved design of the Commission, the following work should be done:

Pilcher's Point, revetment, 15,000 linear feet, at $20	$300,000
Repairs to Cottonwood system, dikes	40,000
Repairs to Stack Island system, dikes	10,000
Total Lake Providence Reach	380,000

I have not included any new work.

Money statements for Lake Providence Reach, care of plant and surveys, and protection of works, third district, are herewith annexed:

LAKE PROVIDENCE REACH.

Money statement.

July 1, 1887, amount available	$9,195.39
July 1, 1888, amount expended	9,195.39
Amount that can be profitably expended in fiscal year ending June 30, 1890*	550,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	
Expenditures apportioned as follows:	
For services	$6,722.16
For material and supplies	48.26
For plant, tools, and repairs	1,090.06
For Subsistence	973.66
For Fuel	3.00
For miscellaneous	358.25
Total	9,195.39

CARE OF PLANT AND SURVEYS.

Money statement.

July 1, 1887, amount available		$24,360.00
July 1, 1888, amount expended	$15,873.33	
July 1, 1888, outstanding liabilities	2,000.00	
July 1, 1888, amount covered by existing contracts		17,873.33
July 1, 1888, balance available		6,486.67

---

* Includes additional plant. For repairs to old work but not including any new work.

Amount that can be profitably expended in fiscal year ending June 30, 1890	$30,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

Expenditures apportioned as follows:

For services	$11,939.56
For material and supplies	92.40
For plant, tools, and repairs	512.34
For subsistence	1,357.60
For fuel	1,520.38
For miscellaneous	451.05
Total	15,873.33

PROTECTION OF WORKS, THIRD DISTRICT.

Money statement.

July 1, 1887, amount available	
Re-allotment, act of August 5, 1866	$25,000.00
Total	25,000.00
Expended	
June 30, 1888, balance available	25,000.00

GREENVILLE HARBOR.

Under an appropriation of $37,500, made by the river and harbor act approved August 5, 1886, for this harbor, I was directed to make an examination and prepare a project. This examination was made in September, 1886.

The Commission, however, decided to defer any work, as the amount available was considered too small. Later, and with the understanding that the city of Greenville would give at least an equal amount, the Commission directed me to submit a project for protecting the bank by submerged dikes, such as had been used on the Memphis front.

In obedience to their orders I prepared a project which was adopted by them on July 2, 1887, and was subsequently approved by the Secretary of War.

The city, by a vote of the people, issued bonds for $50,000 for the work. Of these $47,500 were sold, and the net proceeds, $42,277.10, were deposited in the Bank of Greenville subject to my draft. This, with the appropriation made by the United States, gave a total of $79,777.10 available for the work. The fleet arrived and work began on September 15, 1887; it closed, and the fleet returned to Wilson's Point, January 20, 1888, occupying a period of four months and five days.

The average number of men employed was: September, 67; October, 217; November, 284; December, 250; January, 190; and during the time the following plant: Two steamers, 6 quarter-boats, 2 pile-drivers, 5 mattress-boats, 27 barges, 1 machine shop, 2 yawls, 9 skiffs, and 1 grader.

During September and until the middle of October material was plentiful and labor scarce. In November and December the amount of brush furnished by the contractor fell below the requirements and prevented the employment of as large a force as could be worked to advantage, as the weather and stage of water were both favorable for pushing the work.

During the latter part of December and until the close of the work, the weather was very unfavorable. The various kinds of work may be divided into: Grading the bank, building and sinking subaqueous mats, crib-work and upper bank protection.

Grading.—Part of the grading was done by hand, a sluice-box being used to carry the material shoveled into the river; the water for this purpose was pumped out of the river by a pile-driver; this being found too expensive, in view of the large amount of grading to be done, one of the hydraulic graders was used for the rest of the work. The grader was in service about a month.

Subaqueous mattress.—The usual method of construction was employed in this work, iron rods and wire cables being used to give longitudinal strength.

Crib work.—The method adopted on the Memphis work was used on nine of the dikes. In one dike the frame of the cribs was constructed of sawed gum lumber, 3 by 4 inches, in lengths of 8 and 16 feet, fastened by one-half inch bolts at each intersection.

Upper bank revetment.—The upper 100 feet was made of two layers of brush and the lower part of one layer, in the usual manner. It was found in ballasting the slope during the low-water stage, that the work was so expensive and the progress made so slow (the vertical line to the top of the bank being nearly 40 feet), by carrying the stone up the slope as is usually done, that, to reduce the expense, a plan was devised of utilizing a pile-driver for hoisting the stone in a large wooden box carrying about three-fourths of a cubic yard. The box was suspended to a traveler running on a wire rope 1¼ inches in diameter. The driver was placed on the outside of the stone barge to be unloaded, and the wire rope led from the leads of the driver to the top of the bank, passing over a trestle about 16 feet high on the top of the bank, and anchored to a fastening in the ground about 40 feet behind the trestle. The whole apparatus was shifted from place to place as the ballasting was completed.

During the progress of the work caving occurred at Ranges 10½ and 11. In both places it ceased as soon as mattresses were built and sunk there. On December 29, more than a month after the dike had been finished, a cave took place immediately above Range 8½, at the foot of Washington street.

The cave extended down to the dike proper, the revetment above the dike being undermined. An extra mattress was sunk in front of this cave and carried about half-way up the slope. Since then no further caving has occurred.

After this work was finished a small balance remained, and I decided to build an earthen dam or levee across the foot of the chute, to prevent in a great measure the overpour at the foot of the island. This has now been built and sacked.

By referring to the map accompanying this report it will be seen that the remains of Island 83 throws the main current away from the bank at the upper part of the town. The current strikes the bank at some point near Washington street. From here south the bank caved by the direct action of the current, and between the foot of the island and this point by an eddy current. It was this that enabled me to recommend doing this work on the lower end of a caving bank. It would be safe so long as the island remained. It was then estimated that the island would last at least two years. One of these has now passed, and should no work be done to save the small piece of island the work already done will be lost. An examination of the work was made May 31. All the dikes are intact, and no caving has occurred on the protected bank. The eddy action has been almost obliterated. There are indications of considerable fill having taken place, but a survey will be necessary to determine amount. The work has now stood the severest test to which it is likely to be exposed, and may be pronounced an entire success.

The table of cost given on the map does not include the cost of towing stone paid for by the general service. Adding this makes the cost $101,011.03, or $20.20 per linear foot. For this work I would estimate, to complete 18,000 linear feet, at $20, $360,000.

Material used.

Article.	Quantity.	Article.	Quantity.
Willow brush ....cords..	12,265	Wire ....pounds..	165,000
Willow poles ....do....	2,745	Iron rods........................do....	50,000
Stone ....cubic yards..	13,300	Spikes ....do....	25,000
Lumber ....feet B. M..	18,823	Carriage bolts	1,800

Cost.

Surveys	$373.77
Grading ($1.03 per linear foot)..	2,035.54
Revetment ($4.83 per square foot)	43,410.80
Crib work (3 cents per cubic foot)..	33,853.61
Total	79,673.72

A money statement is appended herewith.

GREENVILLE REACH.

Money statement.

July 1, 1887, amount available		$37.500.00
July 1, 1888, amount expended during fiscal year, exclusive of outstanding liabilities	$37,367.05	
July 1, 1888, outstanding liabilities	16.55	
July 1, 1888, amount covered by existing contracts		37,383.60
July 1, 1888, balance available		116.40
Amount that can be profitably expended in fiscal year ending June 30, 1890		360,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		

Expenditures apportioned as follows:

For services	$7,709.53
For material and supplies	19,279.70
For plant, tools, and repairs	402.13
For subsistence	7,285.22
For fuel	2,356.40
For miscellaneous	334.07
Total	37,367.05

VICKSBURG HARBOR.

Owing to the continuous shoaling in the channel leading from the river to the lake-front of the city of Vicksburg, steamers have been shut out for a longer period each year since the cut-off of 1876.

Many plans have been suggested, and work has been done to keep this channel open throughout the year. A report including plan and estimate made by a Board of Engineer Officers in 1878 is published in the Report of the Chief of Engineers for 1878 (pages 638 to 646, Part I).

Before the organization of the Mississippi River Commission work was begun on Delta Point, opposite Vicksburg, to prevent further recession of the bank at this place. After the organization of the Commission this work was continued, and has thus far been successful. By the river and harbor act approved August 5, 1886, an appropriation was made for this harbor. Under this a survey was made and a project with plans and estimates submitted in March, 1887. This project was later adopted by the Commission and approved by the Secretary of War.

This project is as follows:

To prevent the flow of water into the lake and make a still-water basin in front of Vicksburg. Then to dredge a basin in front of the town, and a canal connecting this with the river. To carry out this project it was proposed to build a dam across the lake from the city to De Soto Island, and a dike from near the river end of the island to the canal, and thence parallel to the canal to the river. The basin to be 1,700 feet long and 300 feet wide, and the canal 75 feet wide at bottom, with the natural slope on land side and one-fifth on water side.

Under this project advertisements were issued on August 5, 1887, for dredging. Only one bid was received.

Abstract of proposals for dredging in Vicksburg Harbor, opened September 5, 1887.

No.	Name and residence of bidder.	Price per yard.
		Cents.
1	Rittenhouse Moore, Mobile, Ala	18

This bid, being considered reasonable, was accepted and contract made.

On November 29, 1887, advertisements were issued for piles, poles, brush, braces, stringers, and stone.

Abstract of bids for material for improving Vicksburg Harbor, opened December 20, 1887.

No.	Name and residence of bidder.	Brush, per cord.	Piles, per foot.	Willow stringers, each.	Cypress stringers, each.	Willow braces, each.	Cypress braces, each.	Stone, per cubic yard.
			Cents.					
1	M. V. McBride, Greenville, Miss*	$1.45	6½	$0.85	$1.05	$0.40	$0.50	....
2	M. V. McBride, Greenville, Miss	1.30	6½	.80	1.00	.37½	.45	....
2	McBride & Evins, Greenville, Miss*	1.45	6½	.90	.90	.50	.50	....
3	Karr & Neil, Van Buren, Mo	1.75	9½	1.30	1.30	.60	.60	....
4	W. L. Killebrew, Memphis, Tenn	1.09	12½	4.00	4.00	1.50	1.50	$1.39
5	Elisha Evins, Memphis, Tenn	1.27½	....	.87½	....	.40	....	....

* Delivered on the work.

Contracts were made with W. L. Killebrew, of Memphis, for brush and stone, and with Elisha Evins, of Memphis, Tenn., for braces and stringers. Piles were bought in open market.

The dam and dike were constructed by day's labor, the plant belonging to the United States being used.

Work was begun on February 1, and suspended and plant returned to Wilson's Point on April 16, 1888. At this time the dam was finished and the dike for a distance of 4,000 feet, all that was expected this season. A gap was left in the dike 100 feet wide to accommodate steamers. In this report and on map the dam and dike are called Dikes Nos. 1 and 2, respectively.

During the construction of Dike No. 1 and Dike No. 2, much delay was caused by the tardiness of the contractors, and both brush and stone had to be purchased in open market to avoid a great increase of expense. In both cases, however, the price paid was the same as the contract price, so that no deductions were made on this account from the contractor. An increase in the tow bill was, however, deducted from the contractor's estimate.

During the progress of the work the following was the average force employed: January, 13 men; February, 101; March, 114; April, 50. The force in January was employed in repairs to plant. The following plant was also used: 1 steamer, 2 quarter-boats, 22 barges, 6 pile-drivers, 4 flats, 10 skiffs, and 2 yawls.

The Dike No. 1 was constructed of three parallel rows of piles, driven in each row 8 feet apart. The distance between the rows was 5 and 11 feet. Each row was fastened longitudinally by stringers spiked and wired, and braces connected the three rows similarly fastened. These were placed near the top of the piles and also about halfway between the top and surface of the ground. The space between the rows 5 feet apart was filled with fasqines of brush, with stone ballasting to hold it in position. The brush forms about five-sevenths of the filling and stone two-sevenths; in addition, both these rows were woven or wattled with brush. This dike now stands at an elevation to top of piles of 45 feet on Vicksburg gauge, about 3 feet higher than the average level of De Soto Island. It is in good condition, except that the heavy filling has settled, and the dam must eventually be still further raised.

Dike No. 2, intended rather as a screen, was lightly built of one row of piles 8 feet apart and wattled. This row was then braced to a second row 16 feet distant, in which the piles were 16 feet apart. Stringers are used in each row, and every second pile in first row braced to a pile in second row. Two breaks have occurred in this dike or screen, one caused by drift and the other by a steamer. It will be necessary to extend this dike some 2,000 feet further. The material dredged has been placed along the base of the dam and dike, and it is hoped that as the canal is dredged to gradually build earthen dams of the material.

The cost of Dike No. 1 was $20,388.86, or $7.28 per linear foot. The cost of Dike No. 2 (or screen), $6,858.70, or $1.71 per linear foot.

Dredging was begun on March 13, the river not having reached a sufficiently high stage until that date. The dredge has been constantly at work since, and has removed to May 31, 140,877 cubic yards, measured in situ. I inclose herewith drawings showing the work done to date.

The contractor was ordered to excavate to 18 feet on gauge at Vicksburg, giving land side slope the same as the bank had before deposit, about two-fifths, and on the island side one-fifth, with bottom width of 100 feet; up to June 1 two cuts have been made the full length of the canal, giving a width of 75 feet. The sides have held a steeper slope than the one proposed thus far. After the completion of the dike work, and during dredging, the river rose steadily until it reached an elevation of 44.2 feet on gauge, April 26. It then fell rapidly until May 22, when it stood at 27 feet; since this time it has risen slowly, standing on June 1, 32.5 feet.

During the rise constant and careful observations were made on the currents in the area inclosed by dikes. Early in the rise a current came in at the proposed mouth of the canal, bringing the sediment-laden water of the river, but was not found further in than the compress. With extreme high water this current increased in velocity, and could be traced to Dike No. 1. No current could be detected through the gap left in Dike No. 2, except that due to wind. Much drift, however, came into the harbor this way.

After the water came to a stand, the pulsation due to the eddy at the mouth of the canal was noticed, and later on a falling river, the current set outward. All of these currents were more powerful than required for merely filling and emptying the basin.

The following deposits were found to have taken place on the canal site during the past year:

Section.	Fill.	Section.	Fill.
	Feet.		*Feet.*
H 1	0.2	E 15	0.7
H 2	0.3	E 16	0.8
H 3	0.3	E 17	0.8
H 4	0.4	E D	0.8
H 5	0.4	E 19	0.8
H 6	0.4	E 20	0.8
H 7	0.5	E 21	0.8
H 8	0.6	E 22	0.9
H 9	0.6	E 23	1.1
H 10	0.6	E 24	1.3
H 11	0.7	B 25	1.5
H 12	0.7	B 26	1.8
E 13	0.7	A	2.3
E 14	0.7	A + 100 feet	2.3

making a total fill over the site of the proposed canal of 51,158 cubic yards.

After the works are complete and the dikes made, if possible, water-tight, I do not think the deposit will be much in excess of my calculations, say between 26,000 and 27,000 cubic yards per year.

Obstructions that were not known to exist have been discovered on the line of the canal, such as wrecked barges, which will have to be removed.

I would recommend that a dredging outfit be purchased out of the next appropriation, as it will be needed annually and the dredging can be done cheaper in that way than by contract.

No work has been done at Delta Point, but several slips have occurred in the bank above the revetment, and it will be necessary to extend the work up-stream if the channel remains as it is. To make this point secure the bank should be protected above the mouth of the Yazoo River.

A reference to the map will show that a long line of bank is now caving above the revetment heretofore built. Four caves have taken place, as shown. These pockets have filled during the high water, but extensive caving along this whole line of bank may be looked for during the next low-water season.

Herewith is a financial statement and an itemized statement of cost.

Detailed statement of cost of dikes.

DIKE NO. 1 (2,800 FEET LONG, THREE ROWS PILES, FILLING, ETC.).

	Superintendence.	Care of plant.	Towing.	Repairs to plant.	Pile driving, bracing, etc.	Wattling, filling, etc.	Total.
Labor	$741.25	$212.33	$279.65	$312.45	$1,730.50	$3,359.13	$6,635.31
Labor subsistence	21.44	27.55		2.81	89.79	189.43	331.02
Subsistence stores	60.90	33.61	81.39	68.54	286.15	811.04	1,341.63
Office and general expenses	16.00	4.00		2.50	12.50	15.00	50.00
Repairs to plant				64.00			64.00
Tug hire					102.66	360.00	462.66
Stone						3,400.00	3,400.00
Brush						3,647.65	3,647.65
Piles					2,021.00		2,021.00
Braces					252.80		252.80
Stringers					447.50		447.50
Wire					428.00	72.76	500.76
Spikes and nails				4.00	140.27	20.00	164.27
Rope		10.27			30.07	16.93	57.27
Oil, oakum, etc		22.03		5.20	25.00	8.56	60.79
Coal	1.50		690.20		255.00		946.70
Stationery	5.50						5.50
Total	846.59	309.79	1,051.24	459.50	5,821.24	11,900.50	20,388.86

DIKE NO. 2 (4,000 FEET LONG, TWO ROWS PILES WATTLED, ETC.).

	Superintendence.	Care of plant.	Towing.	Repairs to plant.	Pile driving, bracing, etc.	Wattling, filling, etc.	Total.
Labor	351.75	88.66	331.68	81.85	1,165.88	830.01	2,799.83
Labor subsistence	19.00	23.26			55.16	101.25	198.67
Subsistence stores	48.65	13.06			181.28	308.03	551.02
Office and general expenses	9.50	3.00		1.09	8.25	2.25	24.09
Repairs to plant				33.63			33.63
Tug hire					25.00	100.00	125.00
Brush						768.45	768.45
Piles					1,216.00		1,216.00
Braces					102.00		102.00
Stringers					274.85		274.85
Wire					166.92		166.92
Spikes and nails					54.76		54.76
Rope		7.00			21.63		28.63
Oil, oakum, etc		16.50			19.50		36.00
Coal			342.81		130.54		473.35
Stationery	5.50						5.50
Total	434.40	151.48	674.49	66.57	3,421.77	2,109.99	6,858.70

SUMMARY.

Labor	$9,435.14	Stone	$3,400.00	Rope	$85.90
Labor subsistence	529.69	Brush	4,416.10	Oil, oakum, etc	96.79
Subsistence stores	1,892.65	Piles	3,237.00	Coal	1,420.05
Office and general expenses	74.09	Braces	354.80	Stationery	11.00
Repairs to plant	97.63	Stringers	722.35		
Tug hire	587.66	Wire	667.68	Total	27,247.56
		Spikes and nails	219.03		

VICKSBURG HARBOR.

Money statement.

July 1, 1887, re-allotment, act of August 5, 1886		$72,500.00
July 1, 1888, amount expended	$53,381.08	
July 1, 1888, outstanding liabilities	500.00	
July 1, 1888, amount covered by existing contracts	18,618.92	
		72,500.00
Amount that can be profitably expended in fiscal year ending June 30, 1890 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		200.000.00

Expenditures apportioned as follows:

For services	$11,964.53
For material and supplies	13,767.96
For plant, tools, and repairs	119.03
For subsistence	1,985.74
For fuel	1,531.06
For dredging	22,822.11
For hire of tug	647.66
For miscellaneous	542.99
Total	53,381.08

REPAIR OF DELTA POINT, LA.

Money statement.

July 1, 1887, amount available	$31.90
Re-allotted, act of August 5, 1886	10,000.00
	10,031.90
July 1, 1888, amount expended	8.00
July 1, 1888, balance available	10,023.90
Amount that can be profitably expended in fiscal year ending June 30, 1890	200,000.00

Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.

Expenditures apportioned as follows:

For services	$8.00

LEVEES.

Amos Bayou to Arkansas City.—The contract of the Tennessee Industrial Company was finished and work accepted on September 6, 1887, 158,436 cubic yards having been placed. Under this contract the levee was raised 1.5 feet above the high water of 1882.

At the meeting of the Mississippi River Commission at Saint Louis, Mo., in November, 1886, money was allotted for the enlarging of this line, and it was ordered that the levees should be built 3 feet above the highest water known at Amos Bayou and thence to decrease in height so that at the Louisiana line it should be 2 feet above.

On July 2, 1887, $56,500 was allotted to this line by the Board of Engineer Officers on building and repair of levees, which allotment was approved by the Secretary of War. Under this allotment it was decided to build the line 3 feet above the highest water from Amos Bayou to Lucca Landing, from there to Arkansas City 2½ feet above, and the rest of the line 2 feet above, except at lake crossings. Under this allotment bids were requested on July 25 and opened on August 25, 1887.

Abstract of bids received for building levee from Amos Bayou to Arkansas City, opened August 25, 1887.

No.	Name and residence of bidder.	Price per yard.
		Cents.
1	Henry Duffin, Memphis, Tenn	35
2	Joseph Flynn, Memphis, Tenn	34¼

These bids being considered too high were rejected and arrangements made with Purcell & Greace and Arnold & De Garis to do the work at 25 cents per cubic yard as an open market transaction.

Purcell & Greace began work on September 12, 1887, and finished February 29, 1888, 82,297.4 cubic yards having been placed in position. Arnold & De Garis began work October 4, 1887, and finished February 22, 1888, 125,923.4 cubic yards having been placed, making a total of enlargement of 208,220.8 cubic yards at a cost of $52,055.21, exclusive of contingent and engineering expenses.

The levee is in good condition from Amos to Lucca Landing; below this the levee is so near the river bank that it was not deemed advisable to spend any more money than could be avoided, as a new line must soon be built.

A portion of the topping between Chicot Village and Arkansas City was left for the Desha County levee board to build in accordance with their agreement. This they did at a cost of $2,500, the amount they had agreed to contribute.

Panther Forest Line.—This line, reported under contract last June, was finished and accepted December 13, 1887. Total yardage placed 302,466, and 91.19 acres cleared, at a cost, exclusive of contingent and engineering expenses, of $63,611.38.

On this line some expense was incurred not covered by the contract in removing logs buried below the base of the levee. This levee is built of very poor material in part, and where this occurs the side slopes were made 1 on 4, and for the rest of the line 1 on 3.

At a meeting of the Board of Engineer Officers on building and repair of levees on July 25 and 26, 1887, an allotment of $155,083 was made for levees in my district on the Tensas Front in Arkansas, and I was directed to advertise for bids on the following lines: Loops Amos Bayou to Arkansas City, Panther Forest Extension, Leland Second Loop, Whiskey Chute, Brooks' Break, Matthews' Bend, Grand Lake.

If these could all be built it would close the entire front from Amos Bayou to Red River, provided the State and local authorities carried out their agreements. The Tensas Basin Levee District of Louisiana were responsible for the line from Arkansas City to the Panther Forest Extension, and Chicot County, Ark., for all other gaps and necessary topping. I was further directed to make contracts and do the work as far as the money would permit, leaving out such portions as might be necessary from the foot of the list.

These lines were advertised August 1, and bids opened September 1, 1887. Abstract herewith.

Abstract of bids received September 1, 1887, *for building levees, Tensas Front, in Arkansas.*

[Bids made per yard.]

No.	Name and residence of bidder.	Loops on line from Arkansas City to Amos Bayou.	Extension of Panther Forest.	Leland second loop.	Whisky Chute.	Brooks Break.	Matthews Bend.	Grand Lake.
		Cents.	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*	*Cents.*
1	J. M. Whitehill, Arkansas City, Ark	21¼						
2	P. F. Lamb, Memphis, Tenn	20⅛	22	19¾		21⅛	21⅛	
3	Geo. Arnold and W. O. Flynn, Memphis, Tenn				32¼	24¾		23⅞
4	Duffin & Bro., Memphis, Tenn	20⅛	24⅛	23	31 37	22	22	21⅛ 25
5	Andrews Bros., Florence, Ala	19¼	19¾	18	28⅛			
6	E. F. Verdel, Memphis, Tenn				39¾			
7	Tapper & Fisher, Friar's Point, Miss	17		17¼				
8	Timothy Sullivan, Memphis, Tenn	32	20	19	45 80	30	32	29
9	Robt. McNamara, New Orleans, La						27	26
10	Arnold & DeGaris, Memphis, Tenn	23¾	23⅞	22			24¼	
11	J. J. Cooney, Memphis, Tenn	20		20			20	
12	L. C. Dulaney, Rosedale, Miss			16				
13	McTighe & McKee, Memphis, Tenn	21	19⅛	18	30 40	20	21⅛	22
14	W. R. Harvey, Memphis, Tenn	19	19	17	34	18	19	
15	R. E. Craig, Lima, Ark., and H. W. Graves, Sterling, Ark							26
16	Geo. Arnold and W. O. Flynn, Memphis, Tenn	22	22⅞	21	38⅛		22⅞	25¾
17	R. E. Craig, Lima, Ark., and I. M. Worthington, Lakeport, Ark			23	83⅛			
18	Daniel T. Hartnett, Memphis, Tenn		22	18¾				
19	John B. McGinty, New Orleans, La					23	23	23⅛
20	Hugh Foran, Memphis, Tenn	22						

It was found necessary to leave out the Grand Lake line, and contracts were made for the construction of the others. Later, however, the citizens living in the neighborhood agreed to build a portion of the Grand Lake line, and a contract was made for a part of it. The following has been done:

Loops Amos Bayou to Arkansas City.—Contractors, Tapper & Fisher. Work begun

October 10, 1887; finished February 25, 1888; yardage, 123,885.4. Cost, exclusive of contingent and engineering expenses, $20,960.50.

Panther Forest extension.—Contractor, W. R. Harvey. Work begun October 1, 1887; finished February 1, 1888; yardage, 119,823.3. Cost, exclusive of contingent and engineering expenses, $22,766.41. Some extra clearing was done on this line outside of the contract, aggregating 5.71 acres at $35 per acre.

Leland second loop.—L. C. Dulaney, contractor. Work begun October 1, 1887; finished April 10, 1888; yardage, 53,128. Cost, exclusive of contingent and engineering expenses, $8,500.59.

Brooks Break.—Contractor, W. R. Harvey. Work begun November 20, 1887; finished February 4, 1888; yardage, 12,566. Cost, exclusive of contingent and engineering expenses, $2,261.88.

Matthews Bend.—Contractor, W. R. Harvey. Work begun September 29, 1887; finished February 4, 1888; yardage, 129,453. Cost, exclusive of contingent and engineering expenses, $24,596.07.

Whisky Chute.—This levee crosses the bed of Lake Chicot, and was ordered to be built 4 feet above high water. Contractors, Andrews Bros. Work begun October 1, 1887, but is not yet finished; owing to the poor foundation, excessive sinking has taken place on this levee, and it was deemed prudent to keep the contractor on the work until after the high water. Work was suspended on April 28, 1888. At this time the water had fallen so much that the levee was safe. The overhaul has been large, and it will be a very intricate problem to determine the actual number of yards put in this levee. No settlement has yet been made with the contractors.

Grand Lake.—This levee crosses the bed of Grand Lake, and was ordered to be built 3 feet above high water. Contractors, McTighe & McKee. There was much delay in starting this work, but it finally began about the middle of December. Heavy sinking took place, but the contractors finished on March 28, 1888. No settlement has yet been made on this work.

It was found necessary to top the levee at Sunnyside, and as the work was very light I found it most economical to have it done as an open market transaction. Isaac M. Worthington did the work. Work began November 21, 1887, and finished March 12, 1888. Yardage, 18,420.22. Cost, exclusive of contingent and engineering expenses, $3,028.97.

The Tensas Basin levee district failed to finish their work and left a gap at Old Eunice Landing through the high water. The high water passed was comparatively low at Cairo, only reaching 45.3 on guage as compared with over 52 feet, which was the highest. At Arkansas City it reached 45.2 feet, being 1.8 foot below high water of 1882. Below here the closing of the gaps in the levees caused a higher stage of water. At Greenville, Miss., 40.55 feet, being 1.15 feet below 1882, and at Lake Providence only .22 foot below 1882.

At Vicksburg it fell off, only reaching 44.18 feet, which is 4.82 feet below extreme high water. At Vaucluse Landing, 8½ miles below Greenville, the water was about half a foot below the high-water mark assumed there. At Grand Lake, 21½ miles below Greenville, the water stood about seven-tenths above the highest water recorded. I account for the increased height at Greenville and Lake Providence by the closing of the gaps in the levee formerly open, and at Vicksburg the flood lacked the large amount that had come down the Yazoo from breaks in the Yazoo Front levees.

The exceedingly high water at Vaucluse and Grand Lake may be accounted for by the unreliability of these marks, and from the fact that they were in the immediate vicinity of large gaps. I would recommend that in levee work on this stretch of river the water of 1888 be taken as a standard, and that the levees be built 6 feet above. This would necessitate the raising of these levees from 1.2 feet at and near Arkansas City to 4.8 feet at Grand Lake. I am unable to give an estimate on the cost of this in Arkansas, but in round numbers would say 3,000,000 yards, say at a cost of $600,000. In Mississippi the levees stand higher, but it would probably take at least 1,000,000 yards at a cost of, say, $200,000.

Of the levees in Louisiana, those lying from State line to some distance below Lake Providence will also need raising, say another 1,000,000 cubic yards, at a cost of $200,000. This makes a total of 5,000,000 yards at a cost of $1,000,000. This probably is less than is actually needed, and wherever this enlarging is not done breaks will probably happen if a very high water occurs.

The United States has undertaken so much work that the margin for survey has been too small. I intend to have a survey of the line in Arkansas made at once, and hope to get the data for Mississippi and Louisiana from the State engineers. In addition to this some new loops must be built where threatened by caving banks. In addition to the gap left open at Old Eunice Landing, a break occurred in the levee about a half mile south of Grand Lake, Ark. This gap was held with but little loss, being only 300 feet wide. This levee was a new one built by the State authorities. The Matthews Bend levee, of poor material, seeped badly, but was at no time in great danger. The total expense during high water was much lower than last year.

Last year I had discharge observations, taken just below Arkansas City, published. This year I had them taken at Wilson's Point, with the following result:

Date.	Gauge reading.	Mean velocity per second.	Area discharge section.	Discharge per second.
		Feet.	*Square feet.*	*Cubic feet.*
April 22	37.80	6.5371	179,795	1,175,338
23	37.85	6.4772	177,905	1,152,330
24	37.80	6.0374	174,672	1,054,575
25	37.80	6.0792	181,421	1,102,896
26	37.73	6.4507	186,180	1,200,995
27	37.60	6.3318	177,932	1,126,636

This shows, disregarding the two small gaps this year, that the maximum amount discharged in 1887 was 1,491,735 and in 1888 1,200,995 cubic feet per second, a difference in round numbers of say 300,000 cubic feet per second at Arkansas City.

The difference in the gauge at this point was 46.65 — 45.18 = 1.47 feet. By arguing on this and discussing the various discharges observed in past years, an approximate idea of the height of the river for an expected maximum discharge may be found.

I send with this report money statement for levees Tensas Front, protection of levees, levees Yazoo Front, available balances third district, approximate value of plant belonging to third district, and list of civilian engineers employed July 1, 1887, to June 30, 1888.

Very respectfully, your obedient servant,

Wm. T. Rossell,
Captain of Engineers.

To Col. C. B. Comstock,
Corps of Engineers, U. S. Army,
President Mississippi River Commission.

LEVEES, TENSAS FRONT, IN ARKANSAS.[*]

Money statement.

July 1, 1887, amount available		$74,697.08
Re-allotment, act of August 5, 1886		211,583.00
September 1, 1887, amount deposited for error		.08
Amount available		286,280.16
July 1, 1888, amount expended	$279,932.13	
July 1, 1888, outstanding liabilities	2,000.00	
July 1, 1888, amount covered by existing contracts	539.19	
		282,471.32
July 1, 1888, balance available		3,808.84
Amount that can be profitably expended in fiscal year ending June 30, 1890 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		600,000.00
Expenditures apportioned as follows:		
For services		$16,341.29
For material and supplies		88.09
For plant, tools, and repairs		114.40
For subsistence		177.74
For contractor's estimates		261,002.71
For miscellaneous		2,207.90
Total		279,932.13

---

[*] Includes "Levees, Tensas front," "Levee Arkansas City to Amos Bayou," "Levees Arkansas City to Louisiana line."

PROTECTION OF LEVEES.

Money statement.

July 1, 1887, amount available		$4,922.98
Re-allotment, act of August 5, 1886		10,057.00
		14,979.98
July 1, 1888, amount expended	$9,153.24	
July 1, 1888, outstanding liabilities	200.00	
July 1, 1888, amount covered by existing contract		9,353.24
July 1, 1888, balance available		5,626.74
Amount that can be profitably expended in fiscal year ending June 30, 1890 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.		15,000.00

Expenditures apportioned as follows:

For services	3,888.03
For material and supplies	2,950.19
For miscellaneous	195.18
For levee work	2,119.84
Total	9,153.24

LEVEES YAZOO FRONT (BEN LOMOND HOOP).

Money statement.

July 1, 1887, amount available	$1,216.77
Expended	0,000.00
July 1, 1888, balance available	1,216.77
Amount that can be profitably expended in fiscal year ending June 30, 1890 Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	200,000.00

RECAPITULATION.—AVAILABLE BALANCES, THIRD DISTRICT, JUNE 30, 1888.

Greenville Reach	$116.40
Delta Point, La	10,023.90
Care of plant and surveys	6,486.67
Levees, Tensas Front	3,808.84
Protection of levees	5,626.74
Protection of works	25,000.00
Levees, Yazoo Front	1,216.77
Total	52,279.32

List of civilian engineers employed on work of river and harbor improvement, third district, in charge of Capt. William T. Rossell, Corps of Engineers, from July 1, 1887, *to June* 30, 1888, *inclusive, under the river and harbor appropriation act approved August* 5, 1886.

Names and residences.	Time employed (months).	Compensation per month.	Where employed.	Work on which employed.
	M. d.			
Arthur Hider, Louisville, Ky.	12	$220	Wilson's Point, La. Greenville, Miss	In local charge of Government fleet. In local charge construction of spur-dikes.
H. St. L. Coppée, Vicksburg, Miss.	10 21	175	Leland, Ark Vaucluse, Ark.	Survey and estimates of levees, Tensas Front.
Do			Vicksburg, Miss	In local charge construction of dam and dike at Vicksburg, Miss.
Henry Goodrich, Lake Providence, La.	6	170	Gaines Landing, Ark Vaucluse, Ark.	Inspector construction of levees, Tensas Front.
	1	150	In the field	Survey of levees, Tensas Front.
R. C. Tollinger, Wrightsdale, Pa.	12	150	Arkansas City, Ark In the field	Construction of Amos Bayou levee. Survey of levees, Tensas Front.

Approximate value of plant belonging to the United States and used upon the Mississippi River, third district.

Class of property.	No.	Approximate value June 1, 1888.
Steam tow-boat *Osceola*	1	$15,300
Steam tow-boat *Vidalia*	1	13,500
Steam tow-boat *Emma Etheridge*	1	10,440
Survey-boat *Meter*	1	5,400
Hydraulic graders	2	30,000
Mattress-boats:		
160 by 30 (4), and 180 by 30 feet (2)	6	12,960
140 by 49 feet (old)	1	720
Screen-boats	4	3,600
Quarter-boats (with outfits):		
135 by 30 feet	1	2,925
130 by 25 feet	10	22,500
100 by 30 feet	1	1,620
80 by 20 feet	2	2,250
70 by 18 feet	1	360
Machine-shop boat	1	4,050
Machine-shop boat (old)	1	225
Carpenter-shop (with outfit)	1	2,430
Floating dry-dock (with machinery)	1	2,700
End docks, 37 by 16 and 27 by 8 feet	2	770
Pump-boat and machinery	1	720
Scow (small)	1	25
Barges (decked and scow-built)	35	39,888
Barges (model)	10	29,453
Pile-drivers, with machinery	16	39,888
Catamaran	1	25
Calking-flats	9	150
Yawls	7	360
Skiffs, 1 at Vicksburg and 1 at Vaucluse	33	165
Coal barges and boats (old)	12	1,800
Tools and appliances (including instruments)	....	730
Surveying instruments	...	2,000
Office furniture, safe, etc	....	300
Total	...	247,254

H 1.

REPORT OF CAPTAIN W. T. ROSSELL, CORPS OF ENGINEERS, UPON THE SURVEY OF VICKSBURG HARBOR.

MEMPHIS, TENN., *March* 18, 1887.

SIR: I have the honor to inclose herewith my report on the survey of Vicksburg Harbor.

* * * * * * *

Very respectfully, your obedient servant,

WM. T. ROSSELL,
Captain of Engineers.

REPORT.

Under the act approved August 5, 1886, * * * $75,000 was appropriated for the improvement of Vicksburg Harbor.

* * * * * * *

Under this clause the Mississippi River Commission directed me to make a survey of the harbor. The survey was made, extending from below Vicksburg to the upper end of Paw Paw Island. It includes Centennial Lake and the Yazoo River from near its upper mouth to where it debouches into the Mississippi River. The field work occupied the party from November 1, 1886, to the middle of January, 1887, and the maps were drawn and office work finished about March 6, 1887.

The survey consisted in:

1. A triangulation of the reach.
2. Meandering the banks and sketching the topography.
3. Locating and measuring sections on bars and in the inner harbor, where sounding was impossible.
4. Leveling all meander lines and sections not sounded.
5. Sounding on section lines throughout the entire river and Lake Centennial.
6. Obtaining direction and force of currents by floats.

* * * * * *

The general change in the main river in this reach during the last few years has been a wearing away of the west side of Paw Paw Island, thus lengthening the bend which was shortened by the chute channel; a deposit of much of this suspended silt at the lower end of the island; a slight cave below Duckport Landing, caused by the rebound of the current from the Paw Paw Bar; a large increase in the bar in front of Nebraska Landing; a caving of the bank for about a mile opposite Nebraska Landing, and a moving and vertical increase of the bar at the mouth of the Yazoo; a caving in the bend below Nebraska Landing and the bar above Delta, a cessation of the changes heretofore taking place at King's Point, and a great increase of the bar just above; a continuation of the northward movement of the medium low-water lines of the bar closing the northwest end of Lake Centennial and all the north side of the Centennial Cut-off, and a corresponding increase in its crest; the continuation also of the heavy caving in the bend below, which threatens the stability of the Louisville, New Orleans and Texas Railroad tracks and the destruction of much of the property intervening between the present bank and the hills; a shoaling of the water in mid-stream from King's Point to West Pass, and a corresponding deepening above and below that reach.

In the inner harbor, the change has been a shoaling throughout the entire Centennial Lake, with the exception of that part adjacent to the north end of De Soto Island, which the muddy water rarely reaches with sufficient silt in suspension to cause appreciable deposit.

* * * * * * *

In the upper or southwest corner of the lake the change has been considerable, the channel from West Pass north to near De Soto Island having filled up as much as 9 feet since 1884, there now being at low water a channel in this end of the lake of but 2 feet at the shoalest crossing. Throughout the inner harbor there has been a fill (as before stated) since last February varying from 4 feet at the southeast entrance, between the point of willows and the main bank, to nothing between Ryan's Mill and the Compress, and thence no fill to the north end of the lake, except a complication of changes near Glass Bayou, due to its influence on the lake bottom during heavy rains, at different stages of water.

* * * * * * *

At the risk of going outside of the requirements of the resolution [directing the survey], I have decided to give my views on dredging in the harbor.

The improvement of Vicksburg Harbor, after the cut-off, was begun under a project submitted by a Board of Engineers, January 22, 1878.

The Board recommended:

1. Protection of Delta Point.
2. Construction of a bar dike.
3. Dredging out of inner harbor.
4. Diversion into the lake of the Yazoo River, and made estimates therefor.

The protection of Delta Point has been accomplished, but, from the perishable nature of the materials (willow brush) where exposed above low water, it has required annual repairs.

Under the Mississippi River Commission dredging was done, as stated already in this report. Nothing further has been done as yet. The filling up of the arms of the lake near the river has been rapid, and a shoal has also formed near the mouth of Glass Bayou. The shoaling of the arms of the lake has been due to the sediment and other material brought in by the river while rising. The great amount of the deposit takes place where the current is checked, and the comparatively clear water reaching the back of the lake makes little or no deposit.

The amount of deposit must bear a direct ratio to the volume of water entering the lake, and if this volume be decreased so will the deposit. At present, not only does the volume of water depend on the area of the lake and the rise of the river, but there is also a current passing through the lake.

To decrease the amount of water entering, I propose to build, just below the mouth of Glass Bayou, a dam (marked proposed dam) and a dike along the ridge (marked proposed dike).

The amount of water entering here will be absolutely fixed by the volume contained in the basin. The dam should, in my opinion, be built above the high-water mark, and the dike also. The dam should be as nearly water-tight as practicable, and the dike should allow the water to pass through, but robbed of most of its silt. Undoubtedly even in this case some shoaling would take place, and periodical dredging would be needed. The amount of such sedimentary deposit can not be accurately predicted. There are similar cases now along the river in the cases of chutes closed at their upper ends. In these cases it is known that they remain open, with but little change from year to year.

The dam was also located to cut off any complications from Glass Bayou.

To dredge the canal and basin * * * will require about 1,900,000 cubic yards, measured *in situ*.

The dike will cost, say	$25,000
The dam will cost, say	10,000
Dredging will cost, say	320,000
Total	355,000

It is proposed to dredge both basin and canal to a depth of 5 feet below the zero of the gauge at Vicksburg, the former with a width of 300 feet, and the latter 75 feet on the bottom with side slopes of 1 to 5.

The dam is to be built of two rows of piles, 8 feet apart and filled in between with brush, longitudinal braces of wood and cross-ties of wire.

The improvement by deflecting dikes is uncertain, and although not expensive in first cost, yet when threatened cut-offs must be prevented, and when the undoubted loss of property by caving banks, where the current is thrown, is taken into consideration, the cost will be very great.

* * * * * * *

Should the Commission decide to dredge, I would recommend that the dam be built and the canal begun at the river and carried for its full width and depth as far as the money will permit. The reason for leaving the dike out for the present is that the growth of willows along the site partially does the work.

* * * * * * *

Respectfully submitted.

Wm. T. Rossell,
Captain of Engineers.

Colonel Q. A. Gillmore,
Corps of Engineers, U. S. A.,
President Mississippi River Commission, New York City.

APPENDIX I.

REPORT OF CAPTAIN DAN. C. KINGMAN, CORPS OF ENGINEERS, UPON OPERATIONS IN THE FOURTH DISTRICT.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., June 6, 1888.

SIR: I have the honor to transmit herewith a report of operations for the fiscal year ending June 30, 1888, for the works in my charge in the fourth district of the Mississippi River.

IMPROVEMENT OF THE HARBOR OF NEW ORLEANS, LOUISIANA.

The adopted project for work in New Orleans Harbor is, first, to cover the caving bank in the Carrollton Bend for a distance of 10,000 linear feet, with a mattress of willow brush, ballasted with stone; second, to protect the portion of bank known as the Gouldsboro Bend, about 5,000 linear feet, by means of sloping submerged spurs, made mostly of brush and stone, and placed at intervals, varying from 500 to 1,600 feet. It is also proposed to protect in like manner the Gretna Bend and the great bend above Gretna.

In pursuance of this project the following work had been done up to the date of my last annual report:

A small amount of mattress had been sunk in the Carrollton Bend, and in the Gouldsboro Bend four of the six proposed submerged spurs had been completed and a fifth partly completed. Most of the material required (excepting brush and lumber) for the remaining spurs was on hand. The plant which had been changed by the substitution of three new weaving barges for the old continuous mattress plant was in laying-up quarters, and during the summer was put in order and made ready for use.

In September a survey of Gouldsboro Bend was begun, to ascertain the condition of the work already done and the effect that had been produced by it. The survey showed that all of the completed spurs were in good condition, except Spur No. 6, which was some 10 or 12 feet below grade. This loss of height may have been due to compression or to the loss of some of the top cribs. It was probably due to both causes combined, for this spur as a matter of experiment was made lighter than the others, containing less brush and less stone. The result shows that the safe limit had been reached in the former spurs, and they will be regarded as a standard for similar work hereafter.

In the latter part of October work was resumed in Gouldsboro Bend and continued until February 26, on which date it was completed. Unfinished Spur No. 5 was first brought to grade by the addition of four cribs 6 feet in thickness. Spur No. 4 was then built. This is one of the largest constructed, it being over 40 feet in height, with its outer end resting in 100 feet of water. The necessary number of cribs was sunk on Spur No. 6 to restore it to grade. This completed the proposed work in this bend. No survey has yet been made to determine the effect of the finished work. Examinations made from time to time while the work was in progress showed that where the spurs were completed they held the bank between them and prevented caving. They also showed that spurs of the standard strength were sufficiently strong and durable. The spurs did not, however, cause any deposit to take place above or below them. The bottom seemed to remain about as it was at the time they were put down.

On December 14 a caving of the bank took place at a point a short distance above Spur No. 6. A survey of the locality showed that a mass of earth in the shape of a semi-ellipse in plan, and having an axis of 300 feet and a semi-axis of 60 feet had moved downward and outward into the river. Its movement was singular. It did not fall suddenly from its place, but advanced with a regular motion, so slow and so gradual that it could hardly be detected by the eye alone. Its measured rate of advance was about a half an inch a minute. Before the cave took place the slope of the bank was very steep, being 3¼ on 1 for the first 35 feet in depth. The earth moved was not washed away, but lies at the bottom, reducing the slope of the bank. Of course so steep a slope of earth could not be permanent, but the immediate cause of the cave was a pond of rain-water collected and held a short distance from the crest of the bank by the railroad tracks. A few months later a similar cave occurred from the same cause in the Carrollton Bend. This cave was not near any of the protected portion of the bank.

In regard to the protection of Carrollton Bend, I would recommend that the method of protection by a continuous mattress be abandoned, and that by submerged spurs be adopted in in its place. I think that the trial has gone far enough now to clearly indicate that the latter method is the best for this locality. It is certainly more dur-

PLA

IN BUIL

able, is easier to construct, and is not more expensive, and an injury to a part of it is not so likely to lead to general destruction.

For details of the last season's work, I would refer to the report of my assistant, Mr. H. S. Douglas, which is transmitted herewith. In this report will be found a tabulated statement of labor and material expended in this work.

The collector of the port has not yet furnished me with the commercial statistics of New Orleans for the past year. It is expected, however, to receive them soon after the close of the fiscal year, and they will then be forwarded.

IMPROVING MISSISSIPPI RIVER (NO LIMIT).

Money statement.

New Orleans Harbor:	
July 1, 1887, amount available	$37,472.40
July 1, 1888, amount expended during fiscal year ending June 30, 1888, exclusive of outstanding liabilities	33,180.44
July 1, 1888, balance available	4,291.96
Amount (estimated) required for completion of existing project	620,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1890	100,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

RECTIFICATION OF THE RED AND ATCHAFALAYA RIVERS.

The adopted project (see report of Chief of Engineers, Part IV, 1885, pages 2560 and 2562) is as follows:

"A series of brush dams should be placed in the Atchafalaya, with the upper one below Bayou des Glaizes, and the others at intervals not exceeding one-quarter of a mile. These dams should be built up to just below low water. It is the intention that these dams shall permit a passage down the Atchafalaya of a volume equal to the flood discharge of Red River, and in construction, their height and the width between spurs can be so adjusted as to accomplish this result.

* * * * * *

"They should be constructed with a sill not less than 300 feet wide, up and down stream, and extending transversely up to the high-water banks. Above low water they should be heavily riprapped. The dam should be built upon this sill, with concentric and diminishing cribs, constructed as are those now being used in New Orleans Harbor. While the ends of these cribs would reach about to low water, their concentric position would leave a depression not less than 5 feet deep over the middle of the crest to afford at all stages access to the navigation of the Atchafalaya.

* * * * * * *

"THE KEEPING OPEN A NAVIGABLE CHANNEL FROM THE RED INTO THE MISSISSIPPI RIVER.

* * * "It has been proposed to effect this by placing a low-water dam across Old River, between the Red and the Atchafalaya, whose crest shall have an elevation of about 10 feet above the obstructions in Upper Old River, which, before the present conditions, induced by the enlargement of the Atchafalaya, was the natural and better channel. The redevelopment of this channel would probably require the assistance of dredging and spur-jetties."

The act of August 5, 1886, appropriated $187,500 for this work, and a plan was prepared as follows for the expenditure of this money: To set aside $15,000 for the maintenance of navigation through Old River during the low-water season of 1887; to purchase the plant necessary for sill construction, and to build one sill.

At the date of my last report, in pursuance of this plan, a survey of the proposed location of the contraction works had been made for comparative purposes and to determine the proper location for the first sill, and the necessary plant was being gathered together to be in readiness for work as soon as the river should reach a sufficiently low stage. I was of the opinion at that time that work could only be done to advantage when the river was quite low. The experience of the past year has indicated, however, that work can be done at almost any stage short of extreme flood. The saving in the cost of brush, stone, etc., which must be brought from a distance, compensates for the increased cost of sinking the mattresses in place.

THE MAINTENANCE OF NAVIGATION THROUGH OLD RIVER DURING THE LOW-WATER SEASON OF 1887.

The method by which it was hoped to accomplish this result was by employing a stern-wheel steam-boat in washing and scraping the mud and sand on the bars, and by the construction of temporary spur-dikes to increase the scour.

The conditions preceding this low water were very unfavorable for securing and maintaining a navigable channel. The flood of 1887 was not excessive at the mouth of Red River. The greatest recorded height on the Barbre's gauge was 43.1 feet, April 9. It reached 49.9 feet in 1882.

The river began to rise in November, 1886, attained its maximum April 19, 1887, and from this time the fall was rapid and unchecked. During this rise and fall the direction of the current in Old River was reversed ten times, and its velocity varied from nothing to a very rapid flow. During the time that the water was falling down to a 15 foot stage, when the wheel of a steam-boat could act with effect on the bottom, the direction of the current was reversed five times, and there was a swift current towards the Mississippi for twenty-one days, a swift current towards the Atchafalaya for seven days, and seventy days on which there was a gentle current or no current at all. As would be expected, this left a large amount of sand in the bed of Old River. This bed had a cross-section broad and flat and no well-defined low-water channel existed through it.

The level of the bottom of the river varied from about 4 feet above the zero of Barbre's gauge to a few feet below, but the whole length of Old River, about 6 miles, would practically be dry ground when the gauges at its extremities should fall to zero. With such a condition of affairs the chance of securing and maintaining a navigable channel during the low-water season, at any cost that would be admissible, was very poor indeed. Still, if the Red and Mississippi rivers should attain a decided difference of level and so cause a current, or if they should not fall below 5 feet on the gauge, there was a fair chance of success. Accordingly, guide-piles were driven across the bars to secure the boats while washing with their wheels, and spur-dikes were built in wide sections to contract the water-way; but all to no purpose. The two rivers fell together and the necessary current was wholly lacking. The Barbre's gauge recorded $1\frac{5}{10}$ feet below zero September 18, the Red River Landing gauge reading $2\frac{2}{10}$ above. In November the Red River Landing gauge went down to within .25 of zero, the lowest for many years. Barbre's gauge then read 1 foot above zero. During all this time the bottom of Old River was out of water, and teams were crossing it on a dry, dusty road. All hope of maintaining a channel was abandoned early in September, and the work done thereafter was simply with a view to take advantage of any rise that might come to clear out the channel. A rise in the Red River finally began about the 1st of December, and on the 10th the gauge at Barbre's Landing reached 8.5 feet, that at Red River Landing reading 2.60. On this day the small steam-boat *Colonel Hooker* passed from the Mississippi to Red River, and navigation was thus resumed in Old River after an interruption of one hundred and twenty days. The Red River continued to rise, reaching 19.1 feet on Barbre's gauge December 31. On the same day Red River Landing gauge read 6.40, thus giving a fall of 13 feet in less than six miles. (The zero of Barbre's gauge is 0.3 above that of the Red River Landing gauge.) The resulting current was of course very strong; the rush and roar of the water was audible for a long distance. The dikes in Old River were not designed to withstand such a terrible current, and of course suffered considerably. The exact amount of injury that they received can not yet be determined as they are still submerged. Under the action of this current the channel became much deeper and straighter, and all of the sand seemed to have been carried out into the Mississippi. The sand at first formed a great bar that extended half-way across the river, but this bar was soon washed away. After this the Old River channel was in very good condition, better than it had been for some years; but no permanent improvement has been made. With changing current it will soon fill up again. It is at present deteriorating, and it is a question whether it will be in any better condition than it was last year when the low stage is reached. Nothing but a regular current flowing in one direction during the latter half of the falling stage of the river can be relied upon to secure and maintain a navigable low-water channel.

AT THE HEAD OF THE ATCHAFALAYA.

The approved project provided for the construction of one of the six sills which are to be placed in the Atchafalaya below Bayou des Glaizes. With the approval of the Commission it was decided to place the upper one first, and the location fixed upon was about 500 feet below the mouth of the bayou. The bottom of the river was carefully dragged, and all snags found were pulled and removed.

In the sill a single course of mattresses 3 feet thick was used, instead of two courses 18 inches thick as was first proposed. No difficulty was experienced in sinking the mattresses exactly in the place desired. They were made to lap 5 feet on each other, and I am satisfied that the bottom was completely covered and protected. When this result can be secured the advantages of a single thick mattress are obvious. It costs less to build and sink than two thin mattresses, and when sunk it has all of the stone on top of it, where it will do the most good.

The sill when completed was 304 feet wide up and down stream. Neither bank was found to have a slope greater than 1 on 4, so that no cribs were needed. The left bank, however, was rough and uneven, and considerable grading was necessary to reduce it to a smooth slope so that a mattress could be placed upon it. The left bank had a well-defined crest and the mattress work was terminated there. Connection with the levee was secured by three earthen spurs with horizontal crests. These spurs being above ordinary high water were simply sodded. On the right bank the mattress ends at a height of about 35 feet on the gauge. It was then connected with the main levee by two sloping earthen spurs paved with stone. These spurs were 10 feet wide on top and had side slopes of 1 on 3. The pavement was about 6 inches thick, the stones set in place by hand as in ordinary rough street paving. I was afraid of the action of waves and current on these structures, and had grave doubts as to their stability. As the water rose against them they became very soft, and it was easy to thrust a stick through them from top to bottom. Nevertheless they held, and now that the water has fallen away from them, they show no injury whatever, and no more settlement than would be expected in a new bank of earth. In high water the current made a strong break over them. Their success in this case makes me think that they could be used to advantage in cases of bank protection to replace the perishable portion of spurs between high and low water.

As the place where the sill was put down is remote and inaccessible, the cost of installation was heavy. It was necessary to erect some buildings and to drive a well to secure a supply of drinking water. This well was sunk in the bed of the river to a depth of 127 feet below zero of the gauge, or about 170 feet below the general level of the country. The well flows, but a pump is used to increase the supply. The water is clear and wholesome and unaffected by the stage of the river. The permanganate test shows it to contain but very little organic matter. When first drawn from the well it contains some soluble salt of iron. This, however, is soon oxidized and precipitated on exposure to the air.

The willow brush required for the work was cut from private land in the vicinity. A price of $1 per acre (equal to about 1¼ cents a cord) was paid for the privilege. The total cost of willows delivered on United States barges at the work was $1.64½ per cord; 7,438 cords were used.

The rock for ballast was quarried by hired labor at a point near Harrisonburg, La., and towed to the work. The Louisiana Manufacturing, Mining and Quarry Company, with whom a contract for stone had been made, failed after delivering 307 tons.

The Government profited by the failure, as the stone was obtained about 20 per cent. cheaper than it would have been under the contract.

The following is a statement of the cost of stone:

Rock quarried at and towed from Harrisonburg, La., September 1, 1887, to March 16, 1888. inclusive:

Cost of quarrying and loading	$14,437.86
Cost of towing	7,028.63
Total cost of 12,176 tons of rock delivered at Simmesport	21,466.49
Cost of quarrying per ton	1.18½
Cost of towing do	57¾
Cost of 1 ton of rock delivered	1.76¼

Estimate does not include price paid for quarry right.

Rock quarried and delivered at West Melville, La., by the Louisiana Quarry Company:

Three hundred and seven and five-tenths tons of rock delivered at West Melville, at $1.75 per ton	538.12½
Cost of loading on barge	242.93½
Cost of towing to Simmsport	44.42
Total cost of 307.5 tons of rock delivered at Simmsport	825.48
Cost per ton delivered	2.68½

Total amount of rock delivered, 12,484.4 tons; at a total cost of $22,291.97; cost per ton, $1.78½.

The cost of loading and towing the rock received at West Melville (*i. e.*, the contractor's rock) was, of course, somewhat heavier than it would have been if a larger quantity had been delivered. A good deal of the rock was obtained from the bed and low-water banks of the Ouachita River. For this no payment was made. When the river rose it was necessary to obtain it from land belonging to private parties. This was done in two cases, a stipulated sum being paid for a general right to quarry rock on the owner's land. Fifty dollars was the consideration in each case. This amounted to about 4 cents a ton in place for the rock thus obtained. The right to quarry there still holds good.

The falling river shows the mattress pretty thoroughly filled with silt.

The high-water area of cross-section of the river at the point where the sill is placed was 63,479 square feet. The area below zero was 15,147 square feet. It is now 59,823 and 13,584 square feet, respectively. This small change in a large section of the river can of course have no noticeable effect on its regimen. The sill will prevent the river from getting any larger at that particular section, but that is about all it can accomplish. A detail plan and estimate has been prepared for a low dam to be erected on this sill whenever the commission shall order its construction. The sill and dam will reduce the high-water section to 50,700 square feet, and the section below zero to 4,500 square feet. Whether this contraction will be sufficient is an open question. A 35-foot stage at Simmsport gives 29 feet at Melville, about 30 miles below; 10 feet more causes only a foot or two rise below, showing that the water must then escape over the banks. The area of discharge at Simmsport at 35 feet was 47,000 square feet; after the proposed contraction it will be 36,000 square feet. The average section near Melville at 29 feet is 37,000 feet. From this it would appear that the lower Atchafalaya will still be overtaxed at extreme high water. Still a greater reduction than 20 per cent. at a given point would hardly be judicious, as it might cause a current that would itself be an obstruction to navigation. The plan of dividing the sills and placing half of them 10 or 15 miles below Simmsport may be worthy of consideration.

The long interruption of navigation due to the closure of Old River, and the loss and hardship suffered by the large number of people whose only route to markets is through this place, caused me no little anxiety and regret, and the temptation to incur unjustifiable expenditures in the hope of affording them relief was very hard to resist.

I have given to the "Atchafalaya problem" much thought and study. I visited the locality eleven times during the past season and spent forty-seven days on the work.

It is evident that there are four different and to some extent conflicting interests to be considered in any plan for the rectification of the Red and Atchafalaya rivers, namely:

1. The navigation of the Mississippi River.
2. The navigation of the Red River and its tributaries.
3. The navigation of the Atchafalaya and its connecting waters.
4. The interests of the inhabitants of the valleys of these several streams.

Whatever is done, therefore, must have in view to maintain at all times the free and unobstructed navigation of the Mississippi River at and near the mouth of the Red; must secure at all stages of the water a safe and easy entrance into the Red River and its tributaries; must effect a like result for the Atchafalaya and its connecting waters; and finally, must secure all of these benefits without producing any change in the high-water regimen of these several rivers whereby territory shall be subjected to overflow which is now safe. And any plan which does not promise to secure all of these results is defective and ought to be rejected. The dangers to be averted and the obstacles to be overcome are, so far as the Mississippi River is concerned, the Angola Bar and the deflection of its waters in ever-increasing quantities down the Atchafalaya, which might in time (due to its shorter length) exceed in capacity the main stream, and finally become the sole outlet of the Mississippi. The first heavy storm would then close the present mouth of the river, the bar at Angola would soon rise above the water, and the city of New Orleans and all the towns and villages for more than three hundred miles from Red River to the jetties would be situated on an inland lake. Nor would this great loss be compensated in any measure by the small advantage of a good harbor at the new mouth. The Atchafalaya Bay is much less favorable for improvement than was the present mouth of the Mississippi.

The present difficulty in Old River is an insufficient low-water channel, due to the frequent changes in the direction of the current, which flows sometimes towards the Mississippi and sometimes from it, and to the existence every year, at different stages of the water, of long periods when there is no current at all. The absence of a current renders the ordinary contraction works almost wholly ineffective. This Old River channel is the obstacle to the entrance of the Red River, and also of the Atchafalaya. During the past season all access to these rivers from the Mississippi was prevented for a period of one hundred and twenty days by reason of this Old River obstruction. This channel can not be maintained by a system of annual dredging at any moderate expense. The obstructed channel is nearly 6 miles long and its bottom is of such shifting and sliding material that the amount of dredging would have to be vastly greater than the apparent results obtained, for the sides would slide in and fill up the cut almost as fast as it was made.

It may perhaps be asked how there can be any danger of the Mississippi going down to the Atchafalaya if Old River is constantly filling up, or how the Atchafalaya can get larger and Old River smaller at the same time. The high-water width of Old River is equal to that of the Mississippi and very much greater than that of the Atchafalaya, so with less mean depth it can carry much more water than the Atchafalaya can. The work of the water is therefore applied to the smaller sections of the latter river many miles below its head. But when once the Atchafalaya is large enough the Mississippi will make very short work with the obstructions in Old River. As to the remedy, several have been proposed, the purpose and effect of which is shown upon the accompanying sketches.

No. 1 represents the condition of the water in these rivers at the present time. The bulk of the Red River water flows seaward through the Atchafalaya; that of the Mississippi, of course, follows its own channel, and there is a current flowing through Upper and Lower Old River to the Mississippi, or the reverse, according as the former is higher or lower than the latter. When the two rivers are at the same level, which happens much oftener than one would suppose, there is no current between them. For the purpose of maintaining navigation through Old River a current from the Red River is more effective, for it carries much less sediment. A gentle current from the Mississippi, loaded as its water is with silt, causes a rapid and extensive deposit in the broad and flat channel of Old River, a deposit that the falling river is seldom able to remove. The deposit has been greater in Upper than in Lower Old River, and the result is that at low stages no water passes through this channel at all, and the condition is as shown in—

No. 2.—Here Upper Old River plays no part at all and is left out of the question. When the current is towards the Mississippi the Red River water divides at the point opposite Barbre's Landing, part going down the Atchafalaya and the rest flowing out to the Mississippi. If this condition could be maintained and the division of the water fairly made the problem would be a very simple one. But whenever the Mississippi is the higher the whole thing is changed. Its silt-bearing water flows towards the Atchafalaya, it raises the water at Barbre's, and the current checks itself. The sediment is thrown down and so the shoaling goes on; and if both rivers get very low the whole of Old River Channel for 6 miles may become bare ground, as it did, practically, this year.

No. 3 shows the plan submitted by one of my predecessors in this office. (See Report of the Chief of Engineers for 1885, Part IV, page 2824.) In this Lower Old River is closed up, the bottom of Red River raised so as to give a suitable fall towards the Mississippi, and the Red River water divided at the head of Turnbull's Island. If this could be effected and an equitable division of the water secured and maintained it would be a solution of the problem. If not, then it would not differ much from what now exists there, as shown on No. 2. The point of division of the water would simply be moved a couple of miles farther north.

No. 4 shows what I have called Mr. Eads's plan, as I believe he was an advocate of it. It consists in closing the Atchafalaya by a high dam and thus causing the Red River to become at all stages a proper tributary of the Mississippi. The objections to this plan are: (1) That it cuts off all communication with the Atchafalaya and its connecting waters. (2) That it greatly disturbs the high-water regimen of the Mississippi and renders the whole valley from Red River Landing to the mouth liable to overflow whenever the Red and the Mississippi are at flood height at the same time. (3) It requires the construction of a dam 100 feet high that shall be able to withstand a head of water of 50 feet; this on such a foundation as can be found in that country. (4) It requires the construction of many miles of high levee on the south and west bank of Red River to keep the dam from being turned. (5) It renders the whole Atchafalaya Valley unfit to live in by exposing it to the constant danger of a disastrous inundation if the dam should happen to give way.

No. 5 represents a connection established between the rivers by means of a canal and locks. In this plan Old River might be closed by means of a dam at Carr's Point, in which case all loss of water down the Atchafalaya would be prevented, or the rivers might be left as they now are, in which case the Atchafalaya would continue to enlarge. The first would be open to about the same objections as in the case of No. 4, with the additional one that the head of water might be on either side of the dam. The canal might of course be located at any point from Bougere down to Plaquemine, or even lower. The principal objection to this plan is the difficulty of constructing, maintaining, and operating a lock where the foundation is so poor, the lift so great, and the conditions to which it is subjected so varied. Besides, navigation through locks is tedious and unsatisfactory and even dangerous for the kind of craft used here, when compared with navigation on a free and unobstructed channel, for it must be remembered that there are coal-tows and timber-rafts as well as steam-boats to be accommodated here.

The plan proposed by the Mississippi River Commission I have given before. It consists of a series of low dams in the Atchafalaya to prevent its further enlargement and limit its outlet capacity. It also provides for a low-water dam across Old River, between the Red and the Atchafalaya, whose crest shall have an elevation of about 10 feet above the obstructions in Upper Old River, to deflect the Red River when below this stage down Upper Old River, which, before the present conditions, induced by the enlargement of the Atchafalaya, was its natural and better channel.

So far as the Mississippi River is concerned, it is all that could be desired, as it prevents the further enlargement of the Atchafalaya and limits its outlet capacity. As to the Red River (in low and intermediate stages) it cuts off direct communication with the Atchafalaya and in effect joins Turnbull's Island on its western boundary to the mainland. The water of the Red must then flow through Upper Old River until it reaches the foot of the island; here the water will divide and part flow to the Atchafalaya and the rest to the Mississippi (see No. 6), just as in No. 2 it divided at Barbre's and in No. 3 at the head of the island.

I have said that the water would divide at the foot of Turnbull's Island, but this would not always take place. The Atchafalaya, being deprived of its supply of water by the Red River Dam, would fall rapidly to something like Gulf level, and this would often cause all of the Red River discharge to turn the point of the island and flow swiftly towards the Atchafalaya. If the end of the island was not protected it would encroach upon it and might in time wash it all away and build it up again and so return to its present condition, flanking the dam. In any case that portion of Old River from Turnbull's Island to the Mississippi, having no regular current flowing through it, would be as bad as ever and the obstructed portion would simply be reduced from 6 miles to 1. This can not be accepted as a complete solution of the Atchafalaya problem.

After a careful study on the ground, during the past season, of all the conditions that enter into the solution of this problem, I offer the following addition to the plan proposed by the Commission. This addition is designed to correct the single defect, which I have already pointed out, in an otherwise satisfactory project.

Beginning at the foot of Turnbull's Island, I would construct a jetty along the middle of the Old River extending out into the Mississippi, this jetty to have a height in due relation to that of the Red River dam and a form in plan such as to deliver the Red River water to the Mississippi with the minimum amount of shock.

The effect of the jetty would be to secure a good and easy entrance into the Red River at all stages, for it would force a current out to the Mississippi during the falling stage of the rivers, and the current of the Mississippi sweeping past the end of the jetty would prevent the formation of the bar that is usually found at the mouth of a tributary. It would also secure an ample and easy entrance into the Atchafalaya, for this river, being deprived of all water from the Red River (when the level of the dam was reached), would become a proper outlet of the Mississippi and could be permitted to take an amount of water (to be regulated by the contraction works in the Atchafalaya) sufficient to maintain a channel through Lower Old River large enough and deep enough for all purposes of navigation. The Mississippi would not lose by this change, for the amount of water that it would receive from the Red would equal or exceed that which it gave to the Atchafalaya. The low-water discharge of the Red River is about 10,000 cubic feet a second. At high water all of these works would be completely submerged, and they could be so planned that they would not reduce the area of the sections at which they were placed below that of the average high-water section of the rivers. Thus they would not increase the disaster of floods and would not render any place liable to overflow which is now safe.

This is the plan which I explained to the Committee on Rivers and Harbors of the House of Representatives when I was ordered to appear before it last winter.

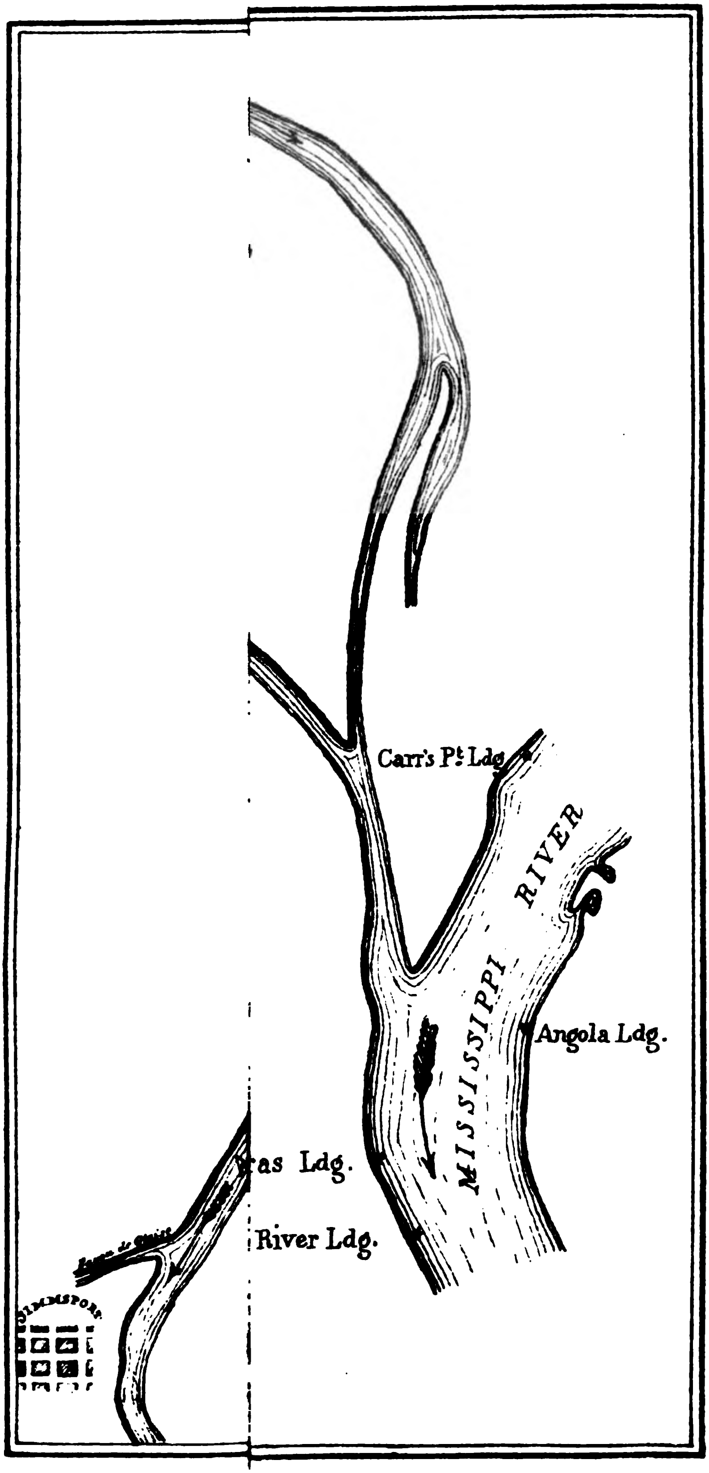
Detail plans and estimates of these several works have been prepared, to be ready in case the Commission should call for them.

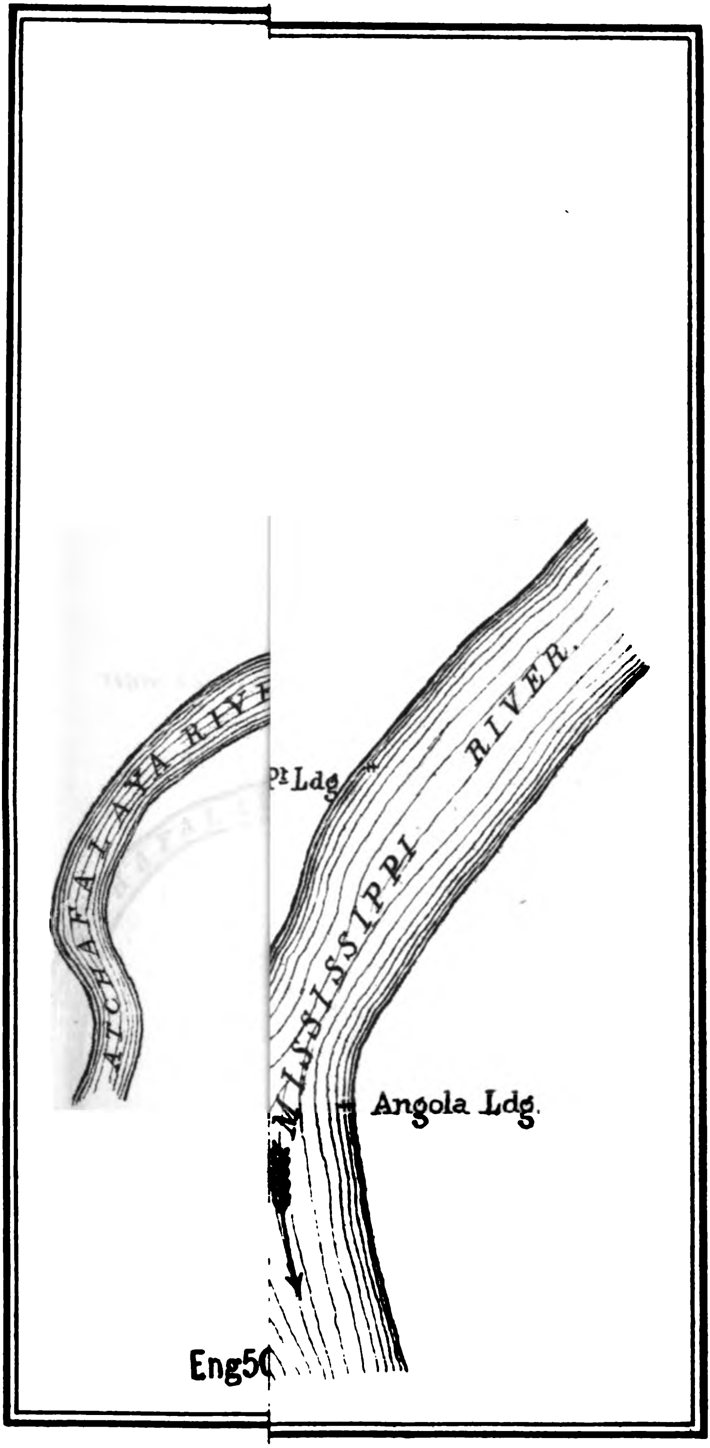
PHOTOGRAPHY.

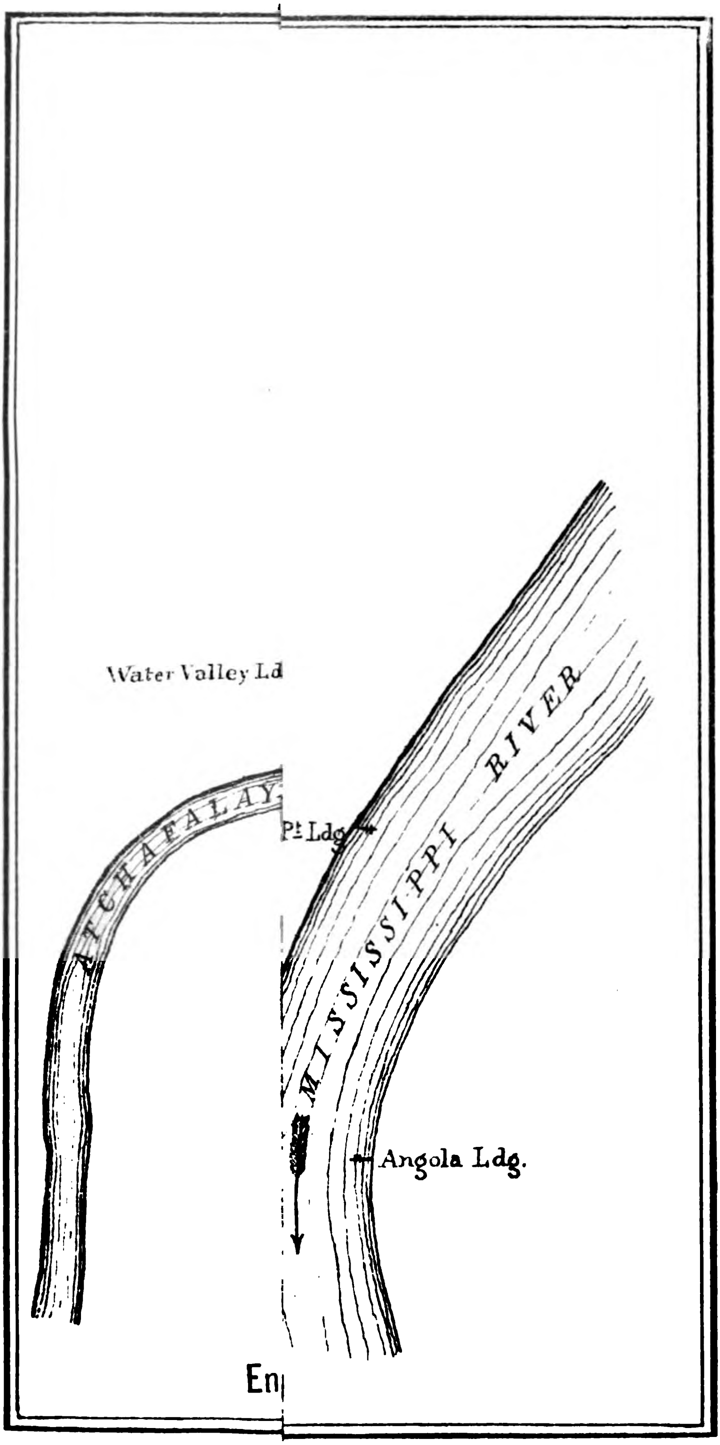
In order to secure views of the work I sent up my own camera for the use of my assistant. He was able to secure a large number of pictures that will form a valuable addition to the history of the work for office record. I transmit herewith a few characteristic views for such use as the Commission may desire to make of them.

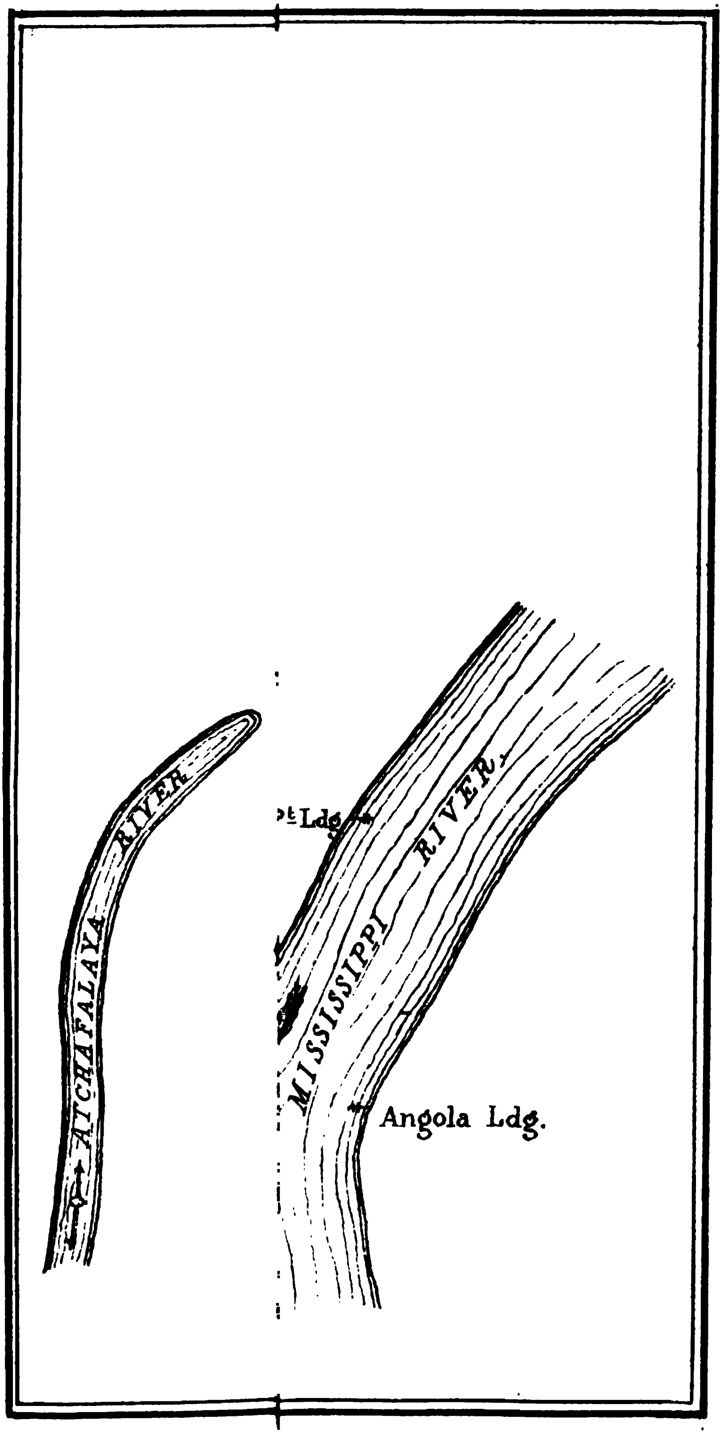
For many interesting details of the work done during the past season for the rectification of the Red and Atchafalaya rivers I would refer to the report of my assistant, Mr. W. G. Price, C. E., who is entitled to much credit for the faithful and skillful execution of the work intrusted to him. Mr. Price's report is transmitted herewith.

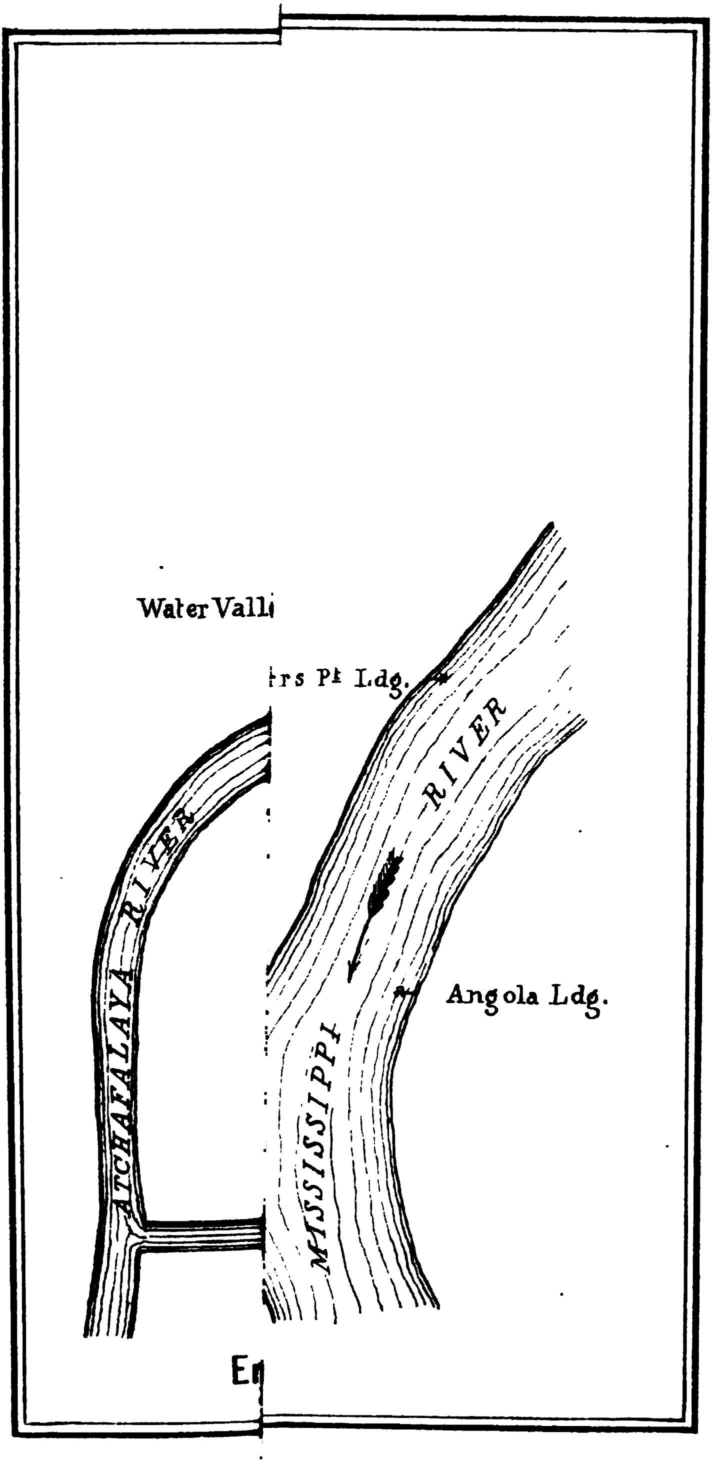
The work is in the collection district of New Orleans, which is the nearest port of entry.

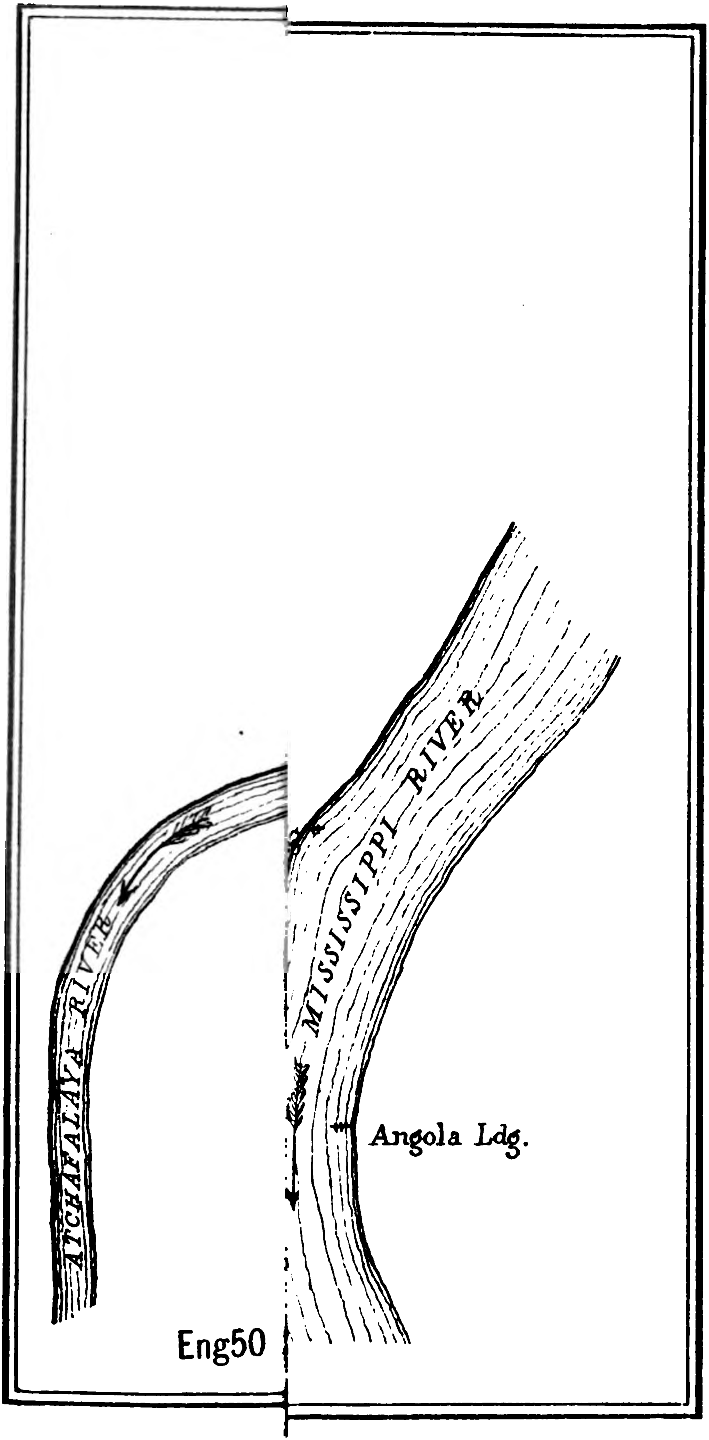

Carr's Pt. Ldg.
MISSISSIPPI RIVER
Angola Ldg.
ras Ldg.
River Ldg.
Bayou de Glaise
SIMMSPORT


ATCHAFALAYA RIVE
Pt Ldg
MISSISSIPPI RIVER.
Angola Ldg.

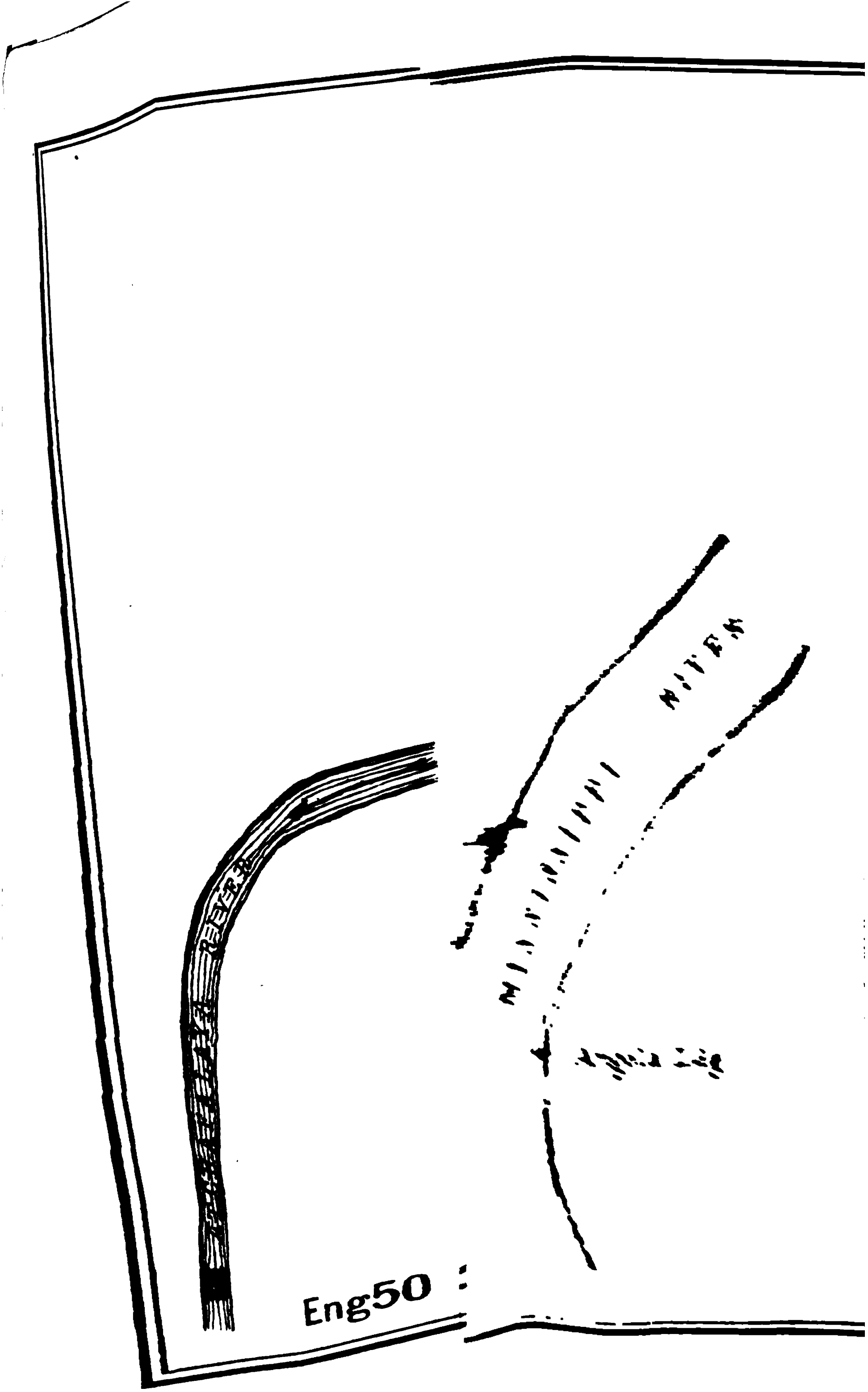

Water Valley Ld
ATCHAFALAY
Pt Ldg
MISSISSIPPI RIVER
Angola Ldg.
En


ATCHAFALAYA RIVER
MISSISSIPPI RIVER
t Ldg
Angola Ldg.


Water Vall
rs Pt Ldg.
RIVER
ATCHAFALAYA RIVER
MISSISSIPPI
Angola Ldg.
E



Eng50



Eng50

COMMERCIAL STATISTICS.

All the river commerce of Red River, Bayous Maçon and Tensas, Ouachita and Black rivers, the Atchafalaya, Bayous Courtableau and Des Glaizes, together with numerous tributaries, and a large portion of the commerce of Bayou Teche, passes through Old River. The total value of the commerce to be benefited by the improvement is estimated at $45,000,000 annually.

IMPROVING MISSISSIPPI RIVER (NO LIMIT).

Money statement.

a. Rectification of Red and Atchafalaya rivers:		
July 1, 1887, amount available	$160,371.16	
May 1, 1888, deposit for overpayment	.10	
		$160,371.26
July 1, 1888, amount expended during fiscal year ending June 30, 1888, exclusive of outstanding liabilities		133,147.54
July 1, 1888, balance available		27,223.72
Amount that can be profitably expended in fiscal year ending June 30, 1890		500,000.00
b. Mouth of Red River:		
July 1, 1887, amount available		350.83
July 1, 1888, amount expended during fiscal year ending June 30, 1888		350.83

CONSTRUCTION AND REPAIR OF LEVEES.

At the date of my last annual report no work of levee construction was in progress. The levees throughout my district were generally in good order. The only gaps on the Tensas Front were: Diamond Island Bend, Deer Park, Bougere Crevasse, and from Black Hawk to Red River. A break was threatened in the United States Kempe Levee, due to rapidly caving banks.

On July 2, $15,000 was assigned to the closure of the Deer Park Crevasse, and on the 25th of the same month, $150,000 was allotted for the construction of a back line of levee in the Kempe Bend, and $6,000 to be applied to the protection of levees during high water.

Surveys were made during the month of August to locate the lines for the new work, and plans and estimates were prepared.

After due advertisement bids for the construction of the two levees were opened September 1. The lowest bids received were: For Kempe Levee 28¼ cents per yard, and for Deer Park 14⅝ cents. Both bids were reasonable and were accepted. Contracts were signed September 23 and September 14, respectively.

The new Kempe Levee has a total length of 19,588 feet. The grade is about 1.5 feet above the high water of 1884. It has a width of crown of 8 feet and side slopes of one on three. The contractors began the work of construction during the latter part of September. The time fixed for its completion was February 1, 1888. It was feared that the front levee would cave into the river before high water. When the time of the contract expired the line was only about half completed. The contractors were well supplied with money and seemed to have made every effort to fulfill their contract. They attributed their failure to bad weather and inability to secure a sufficient force of good laborers. They claimed that they had spared no expense to secure good labor and had even brought men from places as distant as Rochester, N. Y. The levee seems to have a bad name among the workingmen and apparently not without cause, if one can believe all of the reports concerning it. I have heard that no less than eighteen men have been killed there in affrays and drunken brawls. I do not vouch for the truth of these stories. I have no personal knowledge of any act of violence there.

On receipt of the contractor's application for extension of time, I visited the levee and carefully examined the work done and what remained to be done, and satisfied myself that it would be impossible to complete the work before high water, with any force that could be worked there; also, that the front levee would in all probability hold until the river fell. Accordingly, I extended the time for completion to January 1, 1889. Work has been in progress ever since. The old levee has held, and all danger is now past. The new levee will doubtless be finished before the limit fixed.

The new levee is 19,588 feet long, and contains 442,487.20 cubic yards of earth. Up to date 10,994 feet of bank, containing 217,146 cubic yards, has been completed, and all of the right of way has been cleared, leaving 8,594 running feet, containing 225,341 cubic yards yet to be done.

Deer Park Crevasse was a small affair. The total length of levee needed to close it was 12,235 feet, containing 58,006.45 cubic yards of earth. The grade is 2 feet above high water of 1882. Its crown is 6 feet and its front and rear slopes are 1 on 3 and 1 on 2, respectively.

The contractor was very dilatory in beginning this work, and it was not until his bondsmen were threatened (in November) that a proper force was placed on the levee. The work was not completed on expiration of the contract, February 1, 1888, and the time was extended thirty days, but before the month was up the contractor's outfit was seized by his creditors, and work was stopped. As there seemed no prospect of the contractor's completing the levee, I took advantage of paragraph 13 of the specifications, which gives the engineer in charge the right in such cases to place labor on the work at the contractor's cost. Accordingly, I dispatched a quarter-boat with a force of laborers from the Atchafalaya, and completed the levee April 17. No tools or implements were bought for this work, and the expenses were kept down to the minimum; nevertheless the cost of finishing the levee exceeded the contract price per yard. No final settlement has yet been made with the contractor, time being necessary to determine the exact cost of finishing the levee. I would recommend, however, that the contractor be paid the contract price per yard for all the earth he put in the levee. This matter will, however, be made the subject of a separate report later.

In January certain necessary repairs were made on the United States levee from Shipp's Bayou to Hard Times. About 4,200 cubic yards of earth was handled in the repairs. It was left in good condition.

The Glasscock Levee was again damaged by beavers, and a ditch that was dug last year to drain the old borrow-pits was completely dammed up by them. I visited it early in April and caused a number of small charges of dynamite to be exploded in the levee to crush in their galleries and destroy the inmates. I also blew out their dam. The work appeared to be successful.

The flood of 1888 was a moderate one and none of the levees were very severely taxed. The State of Louisiana and the Fifth Louisiana Levee District have undertaken the closure of the Diamond Island Bend. The work was not completed before high water, but doubtless will be this season. With this gap closed the only breaks in the lines of levees in my district will be Bougere Crevasse, about 23,400 feet long, and Black Hawk to Red River, about 90,000 feet. As the water falls, however, additional gaps may be caused by caving banks.

The report of my assistant in charge of levees, Mr. H. S. Douglas, is transmitted herewith.

MORGANZA CREVASSE.

The soundings of the Morganza sections made in 1887 were repeated in February 1888, by a small party detached from the Atchafalaya. The following tables give the results arranged for comparative purposes. They clearly indicate the value of the improvement. These sections are all referred to a water-surface 20 feet above the Memphis datum.

No.—1. *Table showing increase and decrease in area and in hydraulic radius, cross-sections of Morganza Reach, Mississippi River.*

Section.	Area.		Increase.	Decrease.	Hydraulic radius.		Increase.	Decrease.
	1887.	1888.			1887.	1888.		
Above crevasse.								
			Per cent.	*Per cent.*			*Per cent.*	*Per cent.*
Section 1	113,697	110,048		.032	44.3	45.0	.015	
Section 2	121 899	119,845		.016	37.7	37.4		.007
Section 3	99,906	101,182	.012		48.6	48.7	.002	
Section 4	106,841	105,719		.010	58.4	61.3	.040	
Section 5	109,702	112,743	.027		49.2	48.8		.008
Section 6	97,277	100,284	.030		40.8	43.1	.056	
Section 7	101,845	101,767	.004		35.2	36.8	.045	
Below crevasse.								
Section 8	93,093	97,226	.044		33.1	38.1	.151	
Section 9	89,658	94,911	.058		41.0	40.2		.019
Section 10	80,193	92,082	.148		40.1	41.3	.029	
Section 11	81,169	93,192	.148		40.4	41.0	.014	
Section 12	109,733	111,957	.020		48.5	49.7	.024	
Section 13	115,445	113,966		.012	40.0	38.7		.038
Section 14	87,925	97,187	.105		28.0	26.6		.050
Section 15	85,737	87,355	.018		34.9	37.2	.065	

No. 2.—*Table showing increase and decrease in area and in hydraulic radius, cross-sections of Morganza Reach, Mississippi River.*

Section.	Area.		Increase.	Decrease.	Hydraulic radius.		Increase.	Decrease.
	1883.	1887.			1883.	1887.		
Above crevasse.			*Per cent.*	*Per cent.*			*Per cent.*	*Per cent.*
Section 1	112,186	113,697	.013	....	43.5	44.3	.018	....
Section 2	114,583	121,899	.064	....	37.6	37.7	.003	....
Section 3	118,958	99,906	....	.160	67.7	48.6	....	.282
Section 4	110,312	106,841	....	.031	64.8	58.4	....	.098
Section 5	129,750	109,702	....	.154	55.0	49.2	....	.105
Section 6	108,599	97,277	....	.104	42.4	40.8	....	.037
Section 7	104,633	101,345	....	.031	29.5	35.2	.193	....
Below crevasse.								
Section 8	110,970	93,093	....	.161	37.2	33.1	....	.110
Section 9	92,183	89,658	....	.027	37.4	41.0	.096	....
Section 10	109,869	80,193	....	.270	50.6	40.1	....	.207
Section 11	96,967	81,169	....	.162	47.7	40.4	....	.153
Section 12	127,352	109,738	....	.138	58.1	48.5	....	.166
Section 13	131,315	115,445	....	.120	47.4	40.0	....	.156
Section 14	121,404	87,925	....	.275	35.7	28.0	....	.215
Section 15	102,130	85,737	....	.160	42.3	34.9	....	.174

The commerce benefited by levees is all that of the Lower Mississippi River.

The work coming under the general appropriation for improving the Mississippi River from Cairo to the Head of the Passes, no separate appropriation is asked for.

IMPROVEMENT OF THE MISSISSIPPI RIVER AT NATCHEZ AND VIDALIA, MISSISSIPPI AND LOUISIANA.

No work has been done in this vicinity, owing to the lack of funds.

The approved project contemplates the protection of the caving banks by means of submerged sloping spurs placed at intervals to be determined as the work progresses, but assumed for estimate of cost at 1,000 feet. The estimated cost is $600,000.

To prevent the flow of water across the neck of land between Giles and Cow pen bends and the anticipated destruction of the harbors of Natchez and Vidalia by a cut-off, it is proposed to construct a levee at an estimated cost of $100,000. This makes the total estimates $700,000.

The amount which can be profitably expended during the fiscal year ending June 30, 1890, is $250,000, for the purchase of the necessary plant, the construction of the levee, and the commencement of dike work.

COMMERCIAL STATISTICS.

Exact information is not obtainable, but it is estimated that there is received annually at Natchez, Miss., about 40,000 tons of provisions, groceries, and machinery, 7,000 tons cotton-seed, 25,000 tons coal. The shipments are about 40,000 bales of cotton, 4,000 tons oil products. About 1,200 steamers arrive and depart.

At Vidalia, La., the receipts are about 8,000 tons produce, provisions, and machinery, and the shipments about 10,000 bales cotton and 2,000 tons cotton seed, but a railroad recently completed to Trinity, La., has added materially to the commerce of Vidalia.

The work is in the collection district of New Orleans, which is the nearest port of entry.

Money statement.

July 1, 1887, amount available	$825.65
June 1, 1888, amount expended during the period from July 1, 1887, to June 1, 1888, exclusive of outstanding liabilities July 1, 1887	75.00
June 1, 1888, balance available	750.65
Amount (estimated) required for completion of existing project	700,000.00
Amount that can be profitably expended in fiscal year ending June 30, 1890	250,000.00
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

IMPROVING MISSISSIPPI RIVER (NO LIMIT).

Money statement.

(*a*) Levees on Tensas Front:		
July 1, 1887, amount available		$1,900.06
Amount allotted from act of August 5, 1886		165,000.00
		166,900.06
Amount expended during the fiscal year ending June 30, 1888, exclusive of outstanding liabilities	$76,620.10	
July 1, 1888, amount covered by existing contract	70,410.90	
		147,031.00
July 1, 1888, balance available		19,869.06
(*b*) Protection of levees:		
July 1, 1887, amount available		6,496.18
Amount allotted from act of August 5, 1886		6,000.00
		12,496.18
July 1, 1888, amount expended during the fiscal year ending June 30, 1888, exclusive of outstanding liabilities		1,111.15
July 1, 1888, balance available		11,385.03

Abstract of bids for construction of levees, fourth district.

	Name and residence of bidder.	Kempe Levee (price per cubic yard).	Deer Park Levee (price per cubic yard).
		Cents.	*Cents.*
1	Ogden & Jones, Baton Rouge, La	28⅛	15.99
2	Robert M. White, New Orleans, La		14⅝
3	Rogers & Ballentine, New Orleans, La	30	
4	John S. McTighe & Co., Memphis, Tenn	38	17
5	John P. Kennedy, New Orleans, La	34	16⅜
6	Patrick Harnan, New Orleans, La		21
7	William Curry, Saint Joseph, La		19⅛
8	Albert G. Ober, New Orleans, La		18
9	Michael B. McGarry, New Orleans, La		16.74
10	Robert McNamara, New Orleans, La	28⅞	17

Contract awarded to Ogden & Jones for Kempe Levee and to Robert M. White for Deer Park Levee.

Approximate value of plant belonging to the United States and used upon the improvement of Mississippi River, fourth district.

Class of property.	Approximate value June 30, 1888.	Class of property.	Approximate value June 30, 1888.
Steamer *General Newton*	$13,000	Tools and appliances	10,000
Steam-tug *Comstock*	6,500	Office furniture	1,050
Steam-tug *Tilda*	5,000	Surveying instruments	1,500
Steam-launch *Ruby*	3,500	Drawing instruments	200
Steam-launch *Alaska*	3,000	Miscellaneous: Rock, lumber, etc.	10,000
Two quarter-boats	3,000		
Twenty-six barges	50,000	Total value	108,350
One floating store-house	1,400		
Eleven row-boats	200		

List of civil engineers employed on works of river and harbor improvement in charge of Capt. Dan C. Kingman, Corps of Engineers, during the fiscal year ending June 30, 1888, under the river and harbor appropriation act approved August 5, 1886.

Name and residence.	Time employed (months.)		Compensation per month.	Where employed.	Work on which employed.
	M.	*D.*			
H. S. Douglas, New Orleans	12	......	$175	New Orleans	New Orleans Harbor and levees.
W. G. Price, New Orleans	12	......	175	Do.	Rectification of Red and Atchafalaya rivers and mouth of Red River.
John Ewens, Saint Louis, Mo.	11	12	150	Saint Louis, Mo.	

DAN C. KINGMAN,
Captain of Engineers.

Col. C. B. COMSTOCK,
Corps of Engineers,
President Mississippi River Commission, New York City.

CUSTOM-HOUSE, NEW ORLEANS, LA.,
Collector's Office, June 28, 1888.

SIR: I inclose herewith statement containing the statistics of commerce at this port asked for in your letter of the 8th ultimo.

Respectfully, yours,

B. F. JONAS, *Collector.*

Capt. DAN C. KINGMAN,
U. S. Engineer Corps, New Orleans, La.

	Entered.				Cleared.			
	Steam.		Sailing.		Steam.		Sailing.	
	No.	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*	*No.*	*Tons.*
Foreign	425	517, 595	182	129, 668	449	549, 954	141	87, 199
American	106	52, 158	42	11, 613	110	53, 436	37	13, 910
Coastwise	264	407, 973	39	24, 605	216	367, 238	65	58, 736
Total	795	977, 726	263	165, 886	775	970, 628	243	159, 845

Imports:	
Specie	$411, 061. 00
Merchandise, free	5, 187, 818. 00
Merchandise, dutiable	6, 049, 882. 00
Exports:	
Foreign	448, 520. 00
Domestic	79, 999, 367. 00
Total value of exports	80, 447, 887. 00
Duties collected on imports	2, 762, 207. 02

NOTE.—Included in the above are estimated amounts for the month of June, 1888.

I 1.

REPORT OF MR. H. S. DOUGLAS, ASSISTANT ENGINEER.

NEW ORLEANS, LA., *May* 31, 1888.

SIR: I have the honor to submit the following report on the work of improving the harbor at New Orleans, La., from July 1, 1887, to May 31, 1888. Since 1884 the work has been confined to the Gouldsborough Bend under the approved project.

At date of last annual report, June 30, 1887, the condition of the work was as follows: Four of the six proposed submerged spur-dikes had been completed and a fifth was in an unfinished condition, the foundation mattress and three cribs having been placed. Nearly all of the necessary material, except brush and lumber, was on hand. The plant was in laying-up quarters during high water. The ten barges composing the old mattress ways and the tug *Tilda* were being repaired. Three new mattress barges were being built under contract.

From July 1 until September 23 the work was confined to care and preservation of plant. The hull of the *Tilda* was thoroughly repaired and placed in first-class condition. New timber heads were put in barges, decks patched where rotten, and all seams above light water-line caulked. On August 6 the three new mattress barges were completed and received. These were to replace the old mattress ways.

On September 23, a resurvey of the Gouldsborough Bend, to determine the condition of the work previously done, was commenced. Owing to unfavorable weather and other causes, this was not completed until November 3. The survey developed the fact that all the completed spurs were in good condition except Spur No. 6, from which the top cribs had been carried away. No marked change had taken place in the bank slope, and it appeared that the work done had so far occasioned neither a fill nor a scour.

On October 20, the river having fallen to a sufficiently low stage, preparations for the active resumption of spur-dike construction in the Gouldsborough Bend were commenced. Rock for ballasting and sinking the mattresses and cribs was loaded on the barges. Brush contractors were directed to commence delivery of brush, and lumber and other material obtained. New floating crib-ways on which to construct the cribs were built.

The first work decided on was the completion of unfinished Spur No. 5, and on November 7 construction of cribs was commenced. Four cribs were sunk at this spur, which was finished December 6.

On December 6 work on the only remaining untouched spur, No. 4, was commenced. A foundation mattress, 150 by 350 feet, and seven large cribs were sunk at this spur, which was completed February 11, 1888, the work being greatly delayed by fogs and heavy drift accompanying a rapid rise of the river.

On February 12 the repairing of Spur No. 6 was commenced. Four large cribs and three small ones were sunk at this spur, which was completed February 26. At this date the high stage of the river and the heavy drift rendered further work impracticable. The plant was returned to secure laying-up quarters, and placed in as good condition as possible without making extensive repairs. All tools, lines, etc., were placed in good order and carefully stored.

The work done during the past season completes spur-dike construction under the original project in the Gouldsborough Bend. Fifty-two thousand five hundred square feet of mattress and 416,020 cubic feet of crib-work were constructed and placed on the spurs. The estimated cost per square foot of mattress in place was 9.11 cents, and of crib-work in place 4.69 cents per cubic foot. The cost, as stated above, does not include plant nor care and preservation of same while laid up. I believe these figures represent the maximum cost of this character of work, as it was prosecuted during the past season under many disadvantages. The nature of the work is such that personal familiarity with details and methods is necessary to economy. The trained men heretofore employed were not available, and the force engaged had to be taught many things by experience. The former mattress ways were 100 by 358 feet. The new ones used during the past season were only 30 by 358 feet, and while there was an undoubted advantage in handling and placing the new ways, mattress weaving was very much delayed and its expense increased by lack of room on which to handle the brush, poles, rods, etc. Failure of contractors to deliver brush, storms, rain, heavy drift, and dense fogs delayed the work and increased expenses. For eleven days mattress construction was suspended owing to the non-delivery of suitable brush. On spur-dike construction generally, out of 102 possible working days, 23½ were lost from rain, drift, fog, and lack of brush, the lost time being over 20 per cent. From January 22 until February 2 work was virtually suspended, owing to heavy drift in the river. Three times the lowering barges were placed in position to lower cribs on Spur No. 4, and each time the drift banked up against the plant to such an extent that the barges had to be removed to a place of safety.

The methods of constructing and placing the mattress and cribs composing the spurs were generally the same as those described in previous reports. The principal variations were as follows: Instead of making the work light and permeable, it was made as solid and substantial as possible with the material used. In the construction of crib frames iron tie-rods or bolts were dispensed with and replaced by wooden stanchions. The thickness of the cribs was increased to about 6 feet, and the depth of the rock pockets was reduced to about one-third the thickness. The cribs were loaded as heavily with rock before being lowered to the bottom as the lowering lines would stand, and no rock was thrown on them after they were lowered in place.

As to the effect of the work it may be stated that no caving has taken place where the spurs were completed and in good condition. On December 14 a cave commenced a short distance above Spur No. 6. It occurred at the railroad wharf, and its progress was carefully observed. By actual measurement the wharf traveled out into the river at the rate of one-fourth of an inch per minute. In a few days the wharf had been completely wrecked by the cave. for a distance of 250 feet. The causes of the cave are probably the same as have occasioned the wreck of so many other wharves in the harbor. During high water the piles and braces on which the wharf rests check the current and cause a deposit of silt under the wharf nearly up to high-water mark.

At low water this mass of silt, not having the water to support it, slides out into the river, carrying with it the wharf. The immediate cause of the cave may be a prolonged rain, seepage from some inland pond, or the steepness of the bank in front. In this particular case there was a large pond immediately back of the cave, and the bank slope in front of the wharf was very abrupt. It is a well-known fact among those interested in the maintenance of the wharves of the city that when the silt is washed out as the river falls, the sliding in of such structures is prevented to a very great extent.

All work under the original project in the Gouldsborough Bend having been completed, the following summary is presented:

Total quantities of material used in the construction of the six submerged spur-dikes.

Item.	Quantity.	Item.	Quantity.
Rock ....cubic yards..	5,852	Iron bolts ....pounds..	23,183
Brush ....cords..	11,672	Iron washers ....do....	2,300
Lumber ....feet, B. M..	165,710	Iron plates ....do....	1,570
Iron rods, 25 feet long, for mattress weaving ....pounds..	71,470	Spikes and nails ....do ..	12,750
Iron chains, 8-foot links, for mattress weaving....................pounds..	11,690	Galvanized wire ....do....	20,046

Actual working time and amount of work done.

Year.*	Date.	Actual working days.	Mattress placed.	Cribs placed.
			Sq. feet.	*Cu. feet.*
1884....................................	August 29 to November 29	74	210,000	465,036
1886-'87....................................	December 2 to February 14........	64	102,600	377,874
1887-'88....................................	November 7 to February 26........	78½	52,500	416,020
Total....................................	....	216½	365,100	1,258,930

*No work performed in 1885.

Excluding cost of plant and care and preservation of same while not in use, the crib-work has cost an average of 4.57 cents per cubic foot in place. It has been difficult to separate the cost of mattress and crib work, both being under way at the same time, and but two attempts to do so have been made, resulting as follows:

The mattress at Spur 5 cost 7.54 cents per square foot, and the one at Spur 4 cost 9.11 cents per square foot, both in place. In ballasting and sinking the mattresses an average of .128 cubic foot of rock, about 12.29 pounds, were used on each square foot of mattress. On the cribs an average of .0886 cubic feet of rock, about 8.51 pounds, were used to each cubic foot of crib-work. The rock is assumed to weigh 96 pounds per cubic foot, piled and measured in symmetrical piles on barges.

Owing to a series of unfortunate delays, the major portion of the rock used on the work cost $4.11 per cubic yard, delivered on the bank in the harbor. The maximum depth in which the mattresses and cribs were sunk was never less than 100 feet at any of the spurs.

Very respectfully, your obedient servant,

H. S. DOUGLAS,
Assistant Engineer.

Capt. DAN C. KINGMAN,
Corps of Engineers, New Orleans, La.

I 2.

REPORT OF MR. W. G. PRICE, ASSISTANT ENGINEER.

RED AND ATCHAFALAYA RIVERS, ENGINEER OFFICE,
Simmsport, La., May 31, 1888.

SIR: I have the honor to submit the following report of operations for the rectification of the Red and Atchafalaya rivers from July 1, 1887, to May 31, 1888:

OLD RIVER.

The work in lower Old River during the low-water season of 1887 was the construction of five crib spur-dikes and the repair of four old pile-dikes between the foot of Turnbull's Island and Ash Cabin, the construction of two crib spur-dikes in the second crossing near the mouth, and one pile-dike at the mouth.

Mooring piles were driven in the first and second crossings at the mouth, and the steamer *General Newton* was hitched to them and washed the sand out of the channel with her wheel.

The work of putting in the mooring piles began July 26, and the *Newton* began washing out the channel August 1. The Red River Landing gauge on this date read 7.8 feet and the Barbre's gauge read 9.6 feet. The Mississippi and Red were falling very fast and reached a low stage much earlier than usual, and owing to their keeping at nearly an even height there was very little current, and there has usually been a strong current from the Mississippi to the Atchafalaya while the Mississippi was falling from a 10-foot stage. This condition made it impossible to do much at washing out the sand which had been carried in during high water. The steam-boats began grounding August 2, and the river was practically closed after that date, though the *John R. Meigs* pulled through on August 4 and the launch *Ruby* on August 17. The *Newton* was kept busy washing out sand and scraping away the clay until August 17, when, as it was impossible to keep the channel open, this part of the work was abandoned. The work of building and repairing dikes was continued. At the mouth there were two chutes connecting Old River with the Mississippi. The upper one around Carr's Point was kept open by the *Newton*, while the lower one along the Torras shore, by drawing off the water, reduced the head inside the mouth, and thus reduced the depth through Old River. A pile-dike filled with willows and bags of sand was finished August 24, completely closing the lower chute. It was decided to build spur-dikes, which would cause the channel to scour when the river rose, and as the location for them was entirely on dry sand-bars, which made it too expensive to drive piles, they were built of cribs, as follows: First, a mat of willows 1 foot thick, not woven, was laid down to form the apron, which extended out 30 feet on each side and around the end of the dike. Crib frames of yellow-pine timber were then set up 8 feet wide and 6 feet high, the frames being 12 feet apart and filled in with willow poles, brush, and bags of sand. The filling was three-fourths willows and one-fourth sand. The sand bags were placed in the center of the crib and entirely surrounded by willow brush, and the whole was tightly compressed and securely fastened together. The work of constructing the dikes and the repairing of four old pile-dikes began August 6, and was finished September 20. About 1,500 linear feet of dike was constructed, and about 800 linear feet of pile-dike was repaired. The seven new crib-dikes, with the four old pile-dikes, it was thought were all that were required between the bar at the mouth and Ash Cabin. Near Ash Cabin there are a number of hard clay ridges which will require a dredge to remove, and except at this point the whole river from the Mississippi to the Atchafalaya can probably be cut out with a good continuous current of water. The work done this year and in years past has been but temporary and can do no lasting good. In order to permanently deepen the channel it is necessary first to force a current through continually in one direction. This work was completed September 20. On December 9, owing to a rise in the Red and a low stage of the Mississippi, the current through Old River to the Mississippi became terrific, and in order to make navigation safe at the mouth the pile-dike and part of the mooring piles were blown out with Hercules powder. The Red continued to rise till December 30, with 19.2 feet on gauge at Barbre's, and 6.6 feet gauge at Red River Landing, making a fall of about 1.8 feet per mile, and most of the fall was concentrated between Ash Cabin and the mouth. The velocity of the current was unprecedented. It washed out a large amount of sand, which made a bar at the mouth extending far out in the Mississippi, and probably destroyed some of the dikes, but owing to the high stage of water since, no examination of them could be made. Navigation was resumed December 12, having been suspended one hundred and thirty-two days. On February 19 the steamer *Corona* dropped her wheel in the channel of the river near Chandler's warehouse, where there is no obstruction, and as it was in the way of steam-boats it was hauled to the bank.

SILL NO. 1 AT SIMMSPORT.

On August 22 preparations for laying the sill across the Atchafalaya at Simmsport were begun. The plant for this work consisted of 17 barges, 5 quarter-boats, 1 steam-tug, 2 steam-launches, and 1 pile-driver. Eight of the barges were obtained from the work in New Orleans Harbor in exchange for 3 new mattress-ways barges, finished by contract August 6. Two quarter-boats, 3 small barges, and the pile-driver were used in the Old River work and were towed to Simmsport when navigation was resumed. The first work was the sinking of an artesian well to furnish a supply of good water. The Atchafalaya water contains a large amount of organic matter, and as Old River was closed a supply could not be obtained from the Mississippi. A 2-inch pipe was put down 127 feet below the zero of the gauge, and on September 2 a flow of good palatable water was obtained. A store-house for ice was finished September 23. It is 16 feet by 16 feet inside. The walls, floor, and ceiling are double and are packed between with sawdust. It is used for storing perishable subsistence supplies, as well as ice. Ways on which to build the mattresses were constructed as follows, and finished September 26: An old coal-barge was allowed to ground in a level place at high water and when the water had receded it was torn to pieces and a float constructed out of it, which had the gunwales underneath and planks on top, making a smooth deck 85 feet by 62 feet. Way timbers 6 inches square, spliced to make 67 feet in length, were spiked down 6 feet apart and extending 9 feet beyond the edge of the float. On September 28 the work of constructing mattresses was begun. They were 304 feet long, 75 feet wide, and 3 feet thick. The float was anchored 800 feet above the site for the sill and 40 feet from the shore. The upper end was connected with the bank by a float 6 feet wide. Barges of willow were placed against two sides of it so the willows could be thrown off directly into the mattress. The yellow-pine mattress frames were put together on the upper end of the float and moved down to the weavers as fast as finished. The frames were composed of two lines of 2-inch by 4 inch timbers 75 feet long, separated 2 inches, and spliced to break joints with pieces 2 feet long placed between them and the whole nailed together. Posts 2 inches by 4 inches and 3½ feet long and 6 feet apart were fastened at one end between these timbers, each post being secured with one yellow-pine pin three-fourths of an inch in diameter and one 6-inch steel-wire nail. A piece of gas-pipe sharpened at one end and the other screwed into a plate of iron was used for making the pins. The end posts were only 2½ feet long and those next to the end were 3 feet long, so as to make the mattress thinner where they lap together. When the frame had been filled with willows cap-pieces precisely like the bottom pieces first described were put on over the posts, pressed down, and fastened to the post as before. A lever attached to a pair of hooks, similar to ice-hooks, was used for compressing the mattress. The frames were placed 8 feet apart and they were filled with two layers of willow poles and three layers of willow brush. The poles were at top and bottom and the brush between, each layer crossing the preceding layer. The bottom layer of poles was nailed to the frames to give sufficient longitudinal strength. As fast as the frames were filled with willows the mattress was hauled off the ways down-stream by a rope which led to a capstan on shore, and the top layer of poles and the yellow pine caps were then put on. The lower end of the float would sink under water from the weight of the mattress, but with a part of the men wearing rubber knee-boots they could all keep their feet dry. As much as 123 linear feet of mattress was woven in one day with a force of sixty-six men. I think with a force of eighty men 150 linear feet can be finished per day. In order to accomplish this it would be necessary to have always 4 barges of willows on hand to unload from. The bank protection mattresses were the same as those described, except the frames were 12 feet apart.

The mattresses were sunk with the long side parallel with the river, and each one lapped 5 feet over the preceding one. The first mattress was sunk in the deepest water and the others lapped on successively each way to shore. The method of sinking was to hold the mattress in position with ropes which led to anchorages on shore and in the water; the correct distance out being measured with two wires which were stretched from the mattress to the base-line on shore. A loaded barge was placed against the upper end of the mattress and rock thrown on till that end could be lowered to the bottom with ropes. The barge was then allowed to pass over the whole length of the mattress, rock being thrown from both sides of the barge, which pressed it to the bottom. About 100 tons of rock were required to sink a mattress, and afterwards 350 tons more were put on, making in all 42 pounds of rock for each square foot of mattress. In the river it was spread evenly over the surface, but on the bank it was placed so as to cover the pine frames and the top set of poles only, thus leaving uncovered the parallelograms about 8 feet by 3½ feet. The banks on both sides were graded, using shovels and wheelbarrows. All that was required was to even up the surface, as the natural slope was about four to one on the left bank and very much less on the right bank. The mattresses on the left bank were carried to high-water mark and then connected with the levee by three spur-levees. The mattress on the right bank was not carried so high and was connected with the levee by two sloping embankments of earth, which were paved with rock. A portion of the main levee on this side was enlarged and raised above high-water mark.

The work on the sill was completed December 28, except the ballasting of a portion of the bank protection mattress which was delayed so as to allow the rising river to float barges of rock near the work. The ballasting was completed March 1. The willows were cut and loaded by hired labor from Turnbull's Island, near head of the Atchafalaya. All sizes were used, from 1 inch to 6 inches in diameter at the butts.

A contract had been made June 17 with the Louisiana Manufacturing, Mining and Quarry Company to deliver rock at West Melville, but owing to the slow delivery it was decided to obtain rock from the vicinity of Harrisonburg, La., on the Ouachita River. It was quarried and loaded on barges by hired labor and towed to Simmsport. The first load arrived September 8. Most of the towing was done by the launch *Ruby*. The steamer *Delia No. 2* was chartered September 15 to tow rock, and on October 15 the charter was annulled, owing to delays and expense incurred by the frequent breaking of the machinery. These delays and the low stage of the river necessitating the towing of small loads, greatly increased the cost of the rock. All rock received was a silicious sandstone which varied from indurated clay to hard quartzite. Most of it was obtained from the bed and banks of the river and was not paid for. Two small quarries were purchased at an expense for both of $100.

Number of square feet mattress constructed	380,448
Number of cords of willows used	7,438
Number of tons of rock received from Harrisonburg	12,177
Number of tons of rock received from contractors by way of West Melville	307
Number of tons of rock expended on sill	8,571
Number of tons of rock stored for future use	3,913
Number of cubic yards of earth moved in grading banks	4,418
Number of cubic yards of earth moved in building embankments, spur-levees, and raising of main levee	3,812
Cost of mattress per square foot	$0.0613
Cost of mattress per square foot ballasted and sunk, using 42 pounds of rock per square foot, equal to 3¼ cubic feet of mattress and rock	.1042
Cost of willows per cord delivered on barge at Simmsport	1.6475
Cost of quarrying and loading rock at Harrisonburg, per ton	1.1850
Cost of towing rock per ton from Harrisonburg. 130 miles	.5375
Cost of Harrisonburg rock, per ton, delivered on barge at Simmsport	1.7625
Cost of rock per ton, received *via* West Melville, and delivered on barge at Simmsport	2.6850
Average cost of a ration from August 22 to June 3, raw material	.3503
Average cost of a ration from August 22 to June 3, cooked and served, including ice and fuel, but not including expense for cooking utensils	.4488

The health of the men employed was comparatively good. The greatest number sick at one time was 13, on September 30, and partly caused by drinking the impure whiskey sold in the vicinity of the work. Many were troubled with sores on their hands and bodies, caused by impurities in the Atchafalaya water which was used for washing. Whenever rain-water was substituted the sores would heal. It was also noticed that whenever the men drank from the Atchafalaya they were usually attacked with fever within a few days afterwards. A regular physician was employed and quartered on the work from the beginning till January 14.

There were 8 deaths, 4 on the work and 4 immediately after leaving the work. In each of these cases the disease was pneumonia. Many cases of this were caused by the men drinking impure whisky and lying on the ground all night. The liquor traffic was the source of great annoyance.

On February 2 the steamer *General Newton* arrived with barges loaded with storehouse, watchman's quarters, and stores removed from their old location near Natchez, Miss., and the work of rebuilding began on land leased near Simmsport, where the ice-house and artesian well had already been located. The buildings were finished and stores moved into them March 21. The removal was necessary on account of the land at the old location caving into the river.

All other work done since the sill was completed was to properly care for the plant and make such repairs as were necessary.

SURVEYS.

The discharge of Red River at nearly a minimum stage was measured December 2, using rod floats. The section was located 1½ miles above Turnbull's Island.

Area of cross-section in square feet	11,885
Discharge in cubic feet per second	11,853
Mean velocity in feet per second	.994
Gauge at Barbre's	1.3
Gauge at Red River Landing	1.15

The lowest reading of the gauge at Barbre's this season was 1.5 below zero on September 19. Old River was completely closed when the discharge was measured.

The Morganza Reach was resurveyed, beginning January 24 and ending February 1. Fifteen sections were sounded, and the surface of the water at each was connected by levels with bench-marks.

A survey of a portion of Old River near head of Turnbull's Island was made March 20 to 29, to determine best location for a dam. Ten sections were sounded and levelled, extending to high land on each side.

A resurvey of 15 sections in the immediate vicinity of sill No. 1 was made March 31 to April 5.

PHOTOGRAPHY.

The camera arrived too late to secure views of mattress weaving, but many views of interest and value were obtained. Mr. John Ewens, assistant engineer, has been an able assistant on the Old River and Atchafalaya work. He has also made all surveys and attended to taking photographs showing details of the work.

Very respectfully, your obedient servant,

W. G. Price,
Assistant Engineer.

Capt. Dan C. Kingman,
Corps of Engineers.

I 3.

REPORT OF MR. H. S. DOUGLAS, ASSISTANT ENGINEER.

New Orleans, La., *May* 31, 1888.

Sir: I have the honor to submit the following report on the construction and repair of levees from July 1, 1887, to May 31, 1888:

At date of last annual report, June 30, 1887, no work was in progress. The levees throughout the district were generally in good condition. The only gaps existing in the lines of levees were on the Tensas Front, as follows: Diamond Island Bend, Deer Park, Bougere Crevasse, and from Black Hawk to Red River. A gap was seriously threatened in the United States Kempe Levee, owing to the rapid caving of the river bank.

On July 2 the Board of officers on building and repair of levees, at their meeting in New York, assigned $15,000 to be applied to the building of a levee to close the gap at Deer Park from the balance of $71,500 of the allotment for levees made November 29, 1886. The Board again met at Memphis on July 25, and assigned $150,000 to be applied to the construction of a new line of levee at Kempe to close the prospective gap at that point, and $6,000 to be applied to the protection of levees during high water. The action of the Board was approved by the Secretary of War.

During August survey parties were sent out into the field, and preliminary location of the lines for new levees at Kempe and Deer Park staked out. Profiles and estimates were made.

After due advertisement bids for the construction of the two levees were opened on September 1. The lowest bid received for Kempe was 28¼ cents, and for Deer Park 14¾ cents per cubic yard. Both of these bids were accepted. Contract for Deer Park was signed September 14, and for Kempe September 23.

The new Kempe Levee as finally located has a total length of 19,588 feet. The grade is about 1.5 feet above the high water of 1884, crown 8 feet, and side slopes of 3 and 3 to 1. This levee is one of the largest in the district, and considerable difficulty was experienced in locating a line that would be reasonably safe and not contain a greater number of cubic yards than the amount allotted would pay for at the contract price. Several lines were run and estimated on, but final location of the entire line was not and could not be determined on until after the opening of the bids.

Contractors arrived on the ground September 12, and commenced building camps, clearing timber off line, etc. Embankment construction was commenced during the latter part of the month, and has continued to date. It was anticipated that the front levee would cave into the river prior to the high water of 1888, and the original contract date for completion of the new levee was February 1, 1888. Bad weather and the insufficiency of the force employed delayed the work and slow progress was made. Fortunately the old front levee still holds, and high water has not interfered with the continuance of embankment construction. An extension of the time for completion to January 1, 1889, has been granted, and at date work is in progress with a fairly good force for this season of the year.

The total length of the new Kempe Levee is 19,588 feet, and it contains 442,487.20 cubic yards of earth. At date, 10,994 feet of levee, containing 217,146 cubic yards, have been completed. Remaining to complete, 8,594 feet of levee, containing 225,341.20 cubic yards.

Deer Park Levee is a line of light embankment to close a gap caused by caving banks in the United States Green's to Fairview Levee. Its total length is 12,235 feet, and it contains 58,006.45 cubic yards of earth. The grade of the levee is about 2 feet above the high water of 1882, crown 6 feet, with side slopes of 2 and 3 to 1.

The contractor was very dilatory in the prosecution of his work, and it was only when suit against his bondsmen was threatened that a proper force was put on the levee. This was on November 21. From this date until February 19 a fairly good force was kept upon the work, and 36,273.14 cubic yards of earth were placed in the levee. About this date, February 19, the contractor's outfit was seized by his creditors and work virtually suspended. As there seemed to be no prospect of the contractor completing the work, it was decided to enforce paragraph 13 of the specifications, which gives the engineer in charge power in such cases to employ additional labor and purchase additional outfit and place them upon the work.

Accordingly I received instructions from you, February 15, to proceed to Deer Park Levee, put on the necessary force and outfit, and complete the work. I arrived on the ground March 1, and commenced work on the levee March 2. It was found somewhat difficult to obtain labor owing to the lateness of the season, and rainy weather delayed operations considerably. However, on April 17 the levee was completed.

In the latter part of December information was received that a portion of the United States Levee from Shipp's Bayou to Hard Times had settled and needed repairs. An inspection was made and the report found to be correct. Arrangements were made to obtain a small force of men with outfit, and on January 27 repair work was commenced. The total length of levee worked on was 542 feet, and in this distance about 4,200 cubic yards of earth were placed. The repairs were completed February 22, and the embankment left in good condition.

In the early part of March Glasscock Levee was again reported to be damaged by beavers. Repairs had previously been made at this levee. (See Report of the Chief of Engineers for 1887, page 2911.) An inspection was made, and it was discovered that the beavers had again burrowed into the levee at one of the places previously repaired. Owing to the lateness of the season and rising river it was not deemed advisable to cut the levee and make extensive repairs. An attempt to destroy the beavers by exploding small charges of dynamite, so that the fumes would penetrate their dens, was made. It is believed to have been successful so far as this one place is concerned, but it is more than probable that they have injured the embankment at other points besides the one discovered. The ditch previously dug to drain the water out of the borrow-pits had been dammed by the beavers, and this dam was destroyed by being blown up with dynamite. It would seem that the only way of effectually getting rid of the beavers will be to drain all the water from the pits in front of the levee and thus destroy their harbor.

The flood of 1888 has been a very moderate one in this district, and none of the levees have been strained. Residents in the immediate vicinity of Morganza Levee, became somewhat apprehensive as to its safety, but there were no grounds for their fears, and the slight damage to the embankment, consisting principally of rain wash and settling of the banquette behind the levee, has been repaired by the parochial authorities.

The State of Louisiana and the Fifth Louisiana Levee District have undertaken the closure of the Diamond Island Bend Gap. A levee 34,930 feet long, and containing 602,414 cubic yards, was staked out. Work was commenced in the fall of 1887 and is now well advanced, 402,806 cubic yards having been placed in embankment, and the levee completed for a length of 28,330 feet. The recent high river compelled a suspension of work, but it will be resumed this fall, and the levee completed.

Diamond Island Bend being virtually closed, the only gaps in the lines of levees in the district are now Bougere Crevasse, about 23,400 feet long, and from Black Hawk to Red River, about 90,000 feet long. After the subsidence of the present high water some few additional gaps will probably be caused by caving banks.

Very respectfully, your obedient servant,

H. S. DOUGLAS,
Assistant Engineer.

Capt. DAN. C. KINGMAN,
Corps of Engineers, New Orleans, La.

APPENDIX V V.

ANNUAL REPORT OF THE MISSOURI RIVER COMMISSION FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., July 11, 1888.

SIR: The Missouri River Commission beg leave to submit herewith their annual report upon the operations committed to their charge during the fiscal year ending June 30, 1888.

SURVEYS.

This work has been carried on by allotments from the appropriations for improvement, there being no specific appropriation for the purpose. The only field work done consisted of a line of precise levels run from Saint Charles, Mo., to the Saint Louis city directrix to fix accurately the elevation of the Missouri River system of levels.

In the office work has been continued on the reduction and compilation of all physical data in possession of the Commission, with a view to its publication.

The survey of the Missouri River is still incomplete. The triangulation is still to be carried from Leavenworth, Kans., to Trover's Point, Mont., 1,520 miles, permanent bench-marks over the same distance, and also from Berlin, Mo., to the mouth of the river, a total distance of 1,652 miles. Topography and hydrography are required from Fort Pierre to Fort Benton, 1,100 miles. This work is of great national importance, and it is much to be regretted that adequate means have not been furnished for completing it.

For details of work done reference is made to the report of the secretary of the Commission and its appendices.

CONSTRUCTION.

Under this head work has been carried on in the vicinity of Kansas City and Saint Joseph, Mo. These operations were in progress at the date of the last annual report and were continued until the practical exhaustion of the funds in the hands of the Commission.

At Saint Joseph the revetment of Bon Ton Bend, constructed in the early part of the season, was completed by placing a covering of rock on the upper bank protection, and some 3,000 cubic yards of rock were also distributed over portions of the Elwood revetment. The greater portion of the plant was sent to Kansas City for use at that point. Recent changes in this reach indicate the immediate necessity of continuing the Elwood revetment up-stream to Belmont, and work will also be needed in the bend above the Saint Joseph Water-works.

At Kansas City the revetment of the east bottoms was carried to completion, a total distance of 9,035 feet, of which 6,135 feet had been constructed earlier in the season. Work was then carried on in Little Platte Bend above Parkville, and 4,500 feet of bank was protected by revetment.

In addition to this work some small repairs were made to the revetment of 1885 in Upper Kaw Bend, and the dike across the slough at the lower end of Kansas City was repaired and strengthened. This dike, put in to prevent a change of channel in front of the city, has been entirely successful.

All the work of construction was carried on under great difficulties, owing to the scarcity of reliable labor.

PLANT.

The fifteen new barges in process of construction at date of last annual report were completed and delivered.

For details of work see report of the president of the Commission and its appendices.

SURVEYS AT SPECIAL LOCALITIES.

No further work under this head was done during the year, but, in answer to a call for information from Congress, a special report was made upon the condition of affairs at Sioux City, Iowa, with estimate of cost of bank protection desired in that vicinity. (Published as Sen. Ex. Doc. No. 149, Fiftieth Congress, first session.)

RECOMMENDATIONS.

The funds in the hands of the Commission are now about exhausted, being only sufficient to provide for watching plant and public property for a few weeks longer. Under these circumstances the Commission can make no exhibit of work contemplated for the present season, as this must necessarily depend on the provisions of the river and harbor bill now before Congress.

With regard to the year ending June 30, 1890, the Commission renew their recommendation that at least $1,000,000 be appropriated for continuing the general improvement of the river now in progress from Kansas City down-stream. This general appropriation should be in addition to such sums as Congress may see fit to devote to special localities. If less sums than the one recommended be appropriated annually it will be many years before the work can be carried far enough to show any results of value, and the cost will be greatly increased. No engineering difficulty has as yet presented itself to suggest any doubt as to the possibility of carrying the work to a successful conclusion, provided funds are supplied as asked for; but it is proper to state here that during the four years of its existence the Commission have received but two appropriations, aggregating $875,000 less, it will be seen, than their estimate for a single year.

For continuing the survey of the Missouri River; for the examinations and observations required in a thorough study of the problem confided to them, and for salaries, traveling, and office expenses, the Commission recommend an appropriation of $150,000. They also renew their previous recommendation that the $15,000 appropriated for a survey of the Missouri River above the Missouri River Falls, at Fort Benton, be made available for the general survey of the river.

The recommendations of the Commission for the year ending June 30, 1890, are recapitulated as follows:

(1) Appropriation for the improvement of Missouri River from its mouth to Sioux City	$1,000,000
(2) Appropriation for surveys and examinations	120,000
(3) Appropriation for office and traveling expenses and salaries of Commissioners	30,000
(4) Re-appropriation for general survey of Missouri River of the item of $15,000 appropriated in the act of July 5, 1884, for survey of river above the falls	15,000

Money statement.

July 1, 1887, amount available		$177,995.86
Cash received from sales of fuel to officers		182.96
		178,178.82
July 1, 1888, amount expended during the fiscal year, exclusive of outstanding liabilities	$155,637.68	
July 1, 1888, outstanding liabilities	74.69	
July, 1, 1888, unallotted (appropriation for a survey of the Missouri River above the Missouri River Falls, at Fort Benton, act approved July 5, 1884)	15,000.00	
		170,712.37
July 1, 1888, balance available		7,466.45
Amount appropriated by act of August 11, 1888		1,000,000.00
Amount available for fiscal year ending June 30, 1889		1,007,466.45

Respectfully submitted.

CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.,
President Missouri River Commission.
A. MACKENZIE,
Major of Engineers, U. S. A.
O. H. ERNST,
Major of Engineers, U. S. A.
W. J. BROATCH.
G. C. BROADHEAD.

HON. WM. C. ENDICOTT,
Secretary of War.
(Through the Chief of Engineers, U. S. A.)

Financial statement from July 1, 1887, to June 30, 1888.

Work.	Resources.					
	Amount available July 1, 1887, of appropriation act of July 5, 1884.		Amount available July 1, 1887, of appropriation act of August 5, 1886.	Received by transfer from other allotment.	Received from sales of fuel.	Total.
	Allotments.	Unallotted.				
In charge of secretary.						
Improving Missouri River from its mouth to Sioux City, Iowa:						
Office and traveling expenses and salaries of Commission	$13,133.15				$182.96	$13,316.11
Surveys and permanent bench-marks	618.94					618.94
Care of plant, river-gauges, physical data	5,719.38					5,719.38
Special surveys			$2,505.74			2,505.74
In charge of president.						
Improving Missouri River from its mouth to Sioux City, Iowa:						
Kansas City			125,456.29			125,456.29
Saint Joseph			8,841.53	$10,000.00		18,841.53
Construction of plant			6,720.83			6,720.83
Unallotted.						
Survey of Missouri River above the Missouri River Falls at Fort Benton		$15,000.00				15,000.00
Total	19,471.47	15,000.00	143,524.39	10,000.00	182.96	188,178.82

Work.	Expenditures and transfers.				Amount available July 1, 1888.
	Transferred to other allotment.	Amount expended during fiscal year exclusive of outstanding liabilities July 1, 1887.	Outstanding liabilities June 30, 1888.	Total expended and transferred.	
In charge of secretary.					
Improving Missouri River from its mouth to Sioux City, Iowa:					
Office and traveling expenses and salaries of Commission		$11,257.02	$32.19	$11,289.21	$2,026.90
Surveys and permanent bench-marks		618.94		618.94	
Care of plant, river-gauges, physical data		5,399.11		5,399.11	320.27
Special surveys		2,505.74		2,505.74	
In charge of president.					
Improving Missouri River from its mouth to Sioux City, Iowa:					
Kansas City	$10,000.00	111,225.37	25.00	111,250.37	4,205.92
Saint Joseph		17,910.67	17.50	17,928.17	913.36
Construction of plant		6,720.83		6,720.83	
Unallotted.					
Survey of Missouri River above the Missouri River Falls at Fort Benton					15,000.00
Total	10,000.00	155,637.68	74.69	165,712.37	22,466.45
Unallotted					15,000.00
Balance actually available					7,466.45

List of civilian engineers employed on work of river and harbor improvements in charge of Missouri River Commission from July 1, 1887, *to June* 30, 1888, *inclusive, under the river and harbor appropriation act approved August* 5, 1886.

[Improving Missouri River from its mouth to Sioux City.]

Name and residence.	Time employed.		Compensation per month.	Where employed.
	Mos.	*Days.*		
A. H. Blaisdell, Saint Louis, Mo	12	0	$200.00	Saint Louis, Mo.
Samuel H. Yonge, Kansas City, Mo	12	0	200.00	Kansas City, Mo.
S. Waters Fox, Saint Joseph, Mo	12	0	200.00	Saint Joseph, Mo.
O. B. Wheeler, Saint Louis, Mo *	1	15	170.00	Saint Louis, Mo.
O. W. Ferguson, Saint Louis, Mo *	0	15	162.50	In vicinity of Saint Charles and Saint Louis, Mo.
	1	0	145.00	
	0	15	125.00	
	2	16	115.00	Saint Louis, Mo.
D. C. Humphreys, Lexington, Va *	1	0	150.00	Do.
	0	2½	125.00	
W. L. Seddon, Saint Louis, Mo *	0	12½	150.00	Saint Charles, Mo., and Saint Louis, Mo.
C. V. Mersereau, Saint Louis, Mo *	0	15	130.00	Saint Louis, Mo.
R. F. Grady, Saint Louis, Mo *	0	6	130.00	Do.
	2	0	75.00	
James A. Seddon, Saint Louis, Mo	2	0	125.00	Do.
Wynkoop Kiersted, jr., Omaha, Neb. *	0	2	125.00	Do.
C. W. Clark, Saint Louis, Mo *	0	28	125.00	Do.
R. H. Bacot, Kansas City, Mo	9	0	125.00	Kansas City, Mo.
A. H. Weber, Kansas City, Mo	8	15	125.00	Do.
Ed. F. Hermanns, Kansas City, Mo	2	22½	125.00	Do.
B. C. Thayer, Saint Joseph, Mo	9	0	125.00	Saint Joseph, Mo.
V. Schindler, Saint Louis, Mo *	2	0	100.00	Saint Louis, Mo.
T. C. Hughes, Kansas City, Mo	0	27	100.00	Kansas City, Mo.

* On special surveys.

APPENDIX A.

ANNUAL REPORT OF SECRETARY MISSOURI RIVER COMMISSION, 1887-'88.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., June 30, 1888.

SIR: I have the honor to submit the following annual report of the work in charge of the secretary of this Commission, for the fiscal year ending June 30, 1888.

Very respectfully, your obedient servant,

THEO. A. BINGHAM,
First Lieutenant of Engineers, Secretary.

Lieut. Col. CHARLES R. SUTER,
Corps of Engineers, U. S. Army,
President Missouri River Commission, Saint Louis, Mo.

SURVEYS.

Except a little precise leveling no work was done during the year.

The gap in triangulation still to be completed is from Fort Leavenworth, Kans., to Trovers Point, Mont., 1,520 miles.

The gap to be filled with permanent bench-marks is about 1,787.5 miles, there being intervals still incomplete between Waverly, Mo., and the mouth of the river of 267.5 miles.

The precise leveling, above referred to, was done to connect the elevations of the Missouri River permanent bench-marks with the Saint Louis City Directrix. Report to you of November 21, 1887, gives the results, and to it reference is respectfully made. (Hereto appended, marked Appendix A 1.)

The list of Missouri River bench-marks, with their descriptions, elevations, etc., was revised, amended, and corrected to date, and an edition of 240 copies printed in May, 1888, at a cost of $0.67 per copy. It is hereto appended marked Appendix A 2.

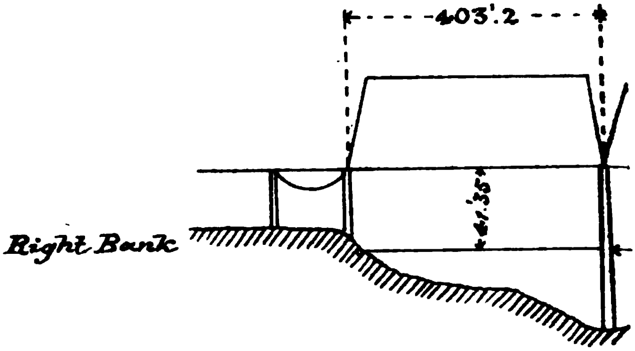
The fleet and plant used for surveys have been cared for on the Kansas City division, being utilized for construction work when so needed.

PHYSICAL DATA.

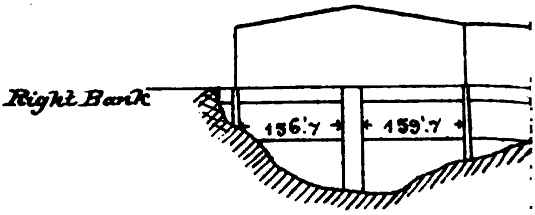
The compilation of the data on file has been completed.

In addition to the regular ones, 11 monthly cross-sections of the river at the Bismarck, Dak., Bridge have been added to our files.

B



AT



Eng50 2

Distances gi

We also keep copies of the following gauge records:

Place.	Location.	Character of gauge.	Continuous record.
Hermann, Mo	300 feet above ferry landing.	Inclined signal servic.	Apr., 1873, to date.
Leavenworth, Kans	Foot of Delaware street	do	May, 1873, to date.
Do	Bridge	Standard wire	Jan., 1872, to date.
Saint Joseph, Mo	Water-works	Vertical pile.	Jan., 1882, to date.
Blair, Nebr	Bridge*		Do.

* Railroad company's gauge.

As soon as funds are available it is the intention to put standard wire gauges on the following bridges: Sioux City (when completed), Nebraska City (when completed), Blair, Randolph, and Sibley.

Owing to decrease in funds all the gauge observers were in March, 1888, put on half-pay, which was a hardship for them, as they are but poorly paid at best ($10 per month); the observer at the Saint Joseph bridge had to be discharged, and if a new appropriation is not available by August 1 all will have to be discharged.

It is not necessary for me to call your attention to the real calamity to all interests connected with the Missouri River which such a cessation of gauge-readings would be. I respectfully urge upon the Commission that the appropriations for preservation and observation of gauges should be continuous, and not dependent each year on the uncertain fate of a river and harbor bill. The importance of this system has been appreciated for the Mississippi River and should be extended to the Missouri River.

MISCELLANEOUS.

Complying with letter from the Chief of Engineers, U. S. Army, of February 15, 1888, a map was made showing the location of all bridges across the Missouri River, with outline cross-sections of river and bridges (hereto appended). A table was also compiled giving the important dimensions and data relative to the bridges. Copies were furnished the Chief of Engineers and members of this Commission.

In April, 1888, a 100-foot steel tape was compared with our 300-foot standard for Lieutenant Carter, Corps of Engineers, U. S. Army, Savannah, Ga., his office bearing the expense, viz, about $25.

In June a comparison under similar conditions was made of a 300-foot steel tape at the request of Captain Quinn, Corps of Engineers, U. S. Army, Duluth, Minn.

A reference map of the Missouri River from Sioux City to the mouth, on a scale $\frac{1}{1,000,000}$, with all information on file in this office, has been nearly completed. The intention is to lithograph this as soon as funds are available. The cost will be small, viz, about $50 for 500 copies.

Under orders from the president of the Commission an inspection was made January 24, 1888, of location, plans, progress, etc., of the Omaha and Council Bluffs Railroad Company's bridge at Omaha. Report was submitted January 26, 1888. The report of the president of the Commission is given in Senate Ex. Doc. No. 83, Fiftieth Congress, first session.

An inspection was also made under orders from the president of the Commission of protection works on left bank of Missouri River at Winthrop, Mo., opposite Atchison, constructed by the railroads whose property was there endangered. Report was submitted April 23, 1888.

ESTIMATES FOR FISCAL YEAR ENDING JUNE 30, 1890.

Office and traveling expenses and salaries of Commission.

Salaries of Commission	$5,000
Mileage	2,500
Office rent	1,200
Telephone	100
Fuel, gas, water, repairs, etc	810
Salaries of clerical force	7,140
Stationery and sundries	750
Publications of records	2,500
Total	20,000

Additional surveys and permanent level bench-marks.

500 miles secondary triangulation, at $90 per mile	$45,000
500 miles topography, at $90 per mile	45,000
500 miles permanent level bench-marks, at $50 per mile	25,000
Total	115,000

Physical data.

Salaries	$5,000
Printing and paper	500
Sundries	260
Eighteen gauge observers	3,240
Repairs to gauges	1,000
Total	10,000

Publications.

Drawings of steamers, barges, other plant specifications, etc	$5,000

Summary.

Office and traveling expenses and salaries of Commission	$20,000
Additional surveys and permanent level bench-marks	115,000
Physical data	10,000
Publications	5,000
Total	150,000

COMMERCE.

The boating trade on the Missouri River is at present very small. It is practically confined to the distance Fort Yates to Fort Benton for the upper river, and Saint Louis to Glasgow for the lower. But these or any other facts as to the small actual amount of boating done on the river now have nothing to do with the question of the improvement of navigation on the Missouri River in its broad meaning and national bearing. For the General Government to foster local interests is supposed to be "foreign to our institutions," and will be clearly a source of political rivalry and intrigue, resulting in unevenly distributed favors from the national purse. But a national system of internal water-ways improvement should result in large gains of national wealth. Reduction in cost of transportation of supplies to market is a business-like method of increasing profits. Here is the Missouri Valley draining an immense grain-bearing (for one thing) district. Large quantities of surplus grain are ready to be put in the world's markets if it can be done for less than the selling price. No proof is needed of the statement that water transportation is cheaper than rail, especially for long distances. Moreover, facts given in my report on this subject to the Commission in 1886 (Annual Report 1886, page 318) show that the river has 600 times greater carrying capacity than a single track railroad.

To improve the river, even between Kansas City and Saint Louis, to a low-water depth of 12 feet is deemed perfectly practicable, and at a cost per mile ($50,000) not exceeding that of a first-class single-track railroad.

Even with the present unimproved channels of the Missouri and Mississippi it is not less than 6 cents cheaper per bushel to transport grain from Saint Louis to Liverpool by way of New Orleans than by way of rail to New York. The saving thus made in one year would more than pay the estimated cost of improving the Missouri River to Kansas City.

The river once improved and insurance on Missouri River barges being then a profitable business (it does not and can not exist at present), the saving per bushel would probably be even greater than it is now.

All these possibilities, which are safe predictions, only receive greater weight from their present non-realization.

"The failure by Congress to make appropriations for the continued improvement of the Mississippi River and its principal tributaries has cost the people of these valleys enormous amounts of money by higher freights, larger risks and increased insurance, wrecks and delays of transportation; and, if continued, will dishearten our river men, if not destroy the business, and thus leave the commerce of the Mississippi Valley to a single method of transportation and practically at its mercy. The result in such a case is not difficult to foresee. The permanent improvement of our water-ways is imperatively demanded in the interest of cheaper transportation to the sea and intercommunication between points on these water-courses.

"Mr. Fink, in his testimony before the select committee on interstate commerce of the United States Senate, admitted the effect of the Mississippi River, the lakes, and the Erie Canal in the regulation of rates to the sea-board, in competition with railroads; and the Interstate Commerce Commission, in their report to Congress this year, refer to the value of water navigation in the regulation of freight rates to all competing points on or near the water-ways. The permanent improvement of the great Mississippi River water system, affording 15,000 miles of water navigation, will secure lower and more stable rates of freight than most legislation, and will do it by the laws of competition between different modes of transportation." (President Gaiennie's report to Merchants' Exchange of Saint Louis, January 3, 1888, page 12.)

"The river trade, though hampered during the past season by low water, is developing yearly, and forms a very important outlet to the sea for our foreign grain trade.

* * * * * * *

"The foreign trade, taken as a whole, *via* New Orleans and *via* the eastern sea-board, has been large, showing that Saint Louis is known in all the markets of the world." (Report for 1887 of Secretary Morgan, of Saint Lous Merchants' Exchange, pages 21 and 22.) This, too, while the great feeder, the Missouri River, is practically idle."

Report Merchants' Exchange, Saint Louis, 1887, *page* 64.—Saint Louis and Missouri River, 1887: Steamers arrived, 161; steamers departed, 171. Receipts in tons, 27,700; shipments in tons, 14,580. Receipts in tons for 1886, 32,620.

Page 73.—Shipments bulk grain, Saint Louis to New Orleans, 1887: Wheat, 3,973,737 bushels; corn, 7,365,340 bushels; total, 327,092 tons.

Page 107.—Receipts at Saint Louis by Missouri River: 27,700 tons in 1887; 32,620 tons in 1886; 16,875 tons in 1885; 28,825 tons in 1884. Shipments: 14,580 tons in 1887; 24,255 tons in 1886; 10,330 tons in 1885; 15,285 tons in 1884.

Page 131.—Direct shipments, Saint Louis to foreign countries, by river to New Orleans: 325,442 tons in 1887; 232,352 tons in 1886; 231,552 tons in 1885; 175,126 tons in 1884; 301,629 tons in 1883; 176,583 tons in 1882; 389,587 tons in 1881.

Page 159.—Sources of supply for three years: The West by rail and Missouri River, 11,164,929 bushels corn in 1887; 11,350,690 bushels corn in 1886; 18,055,357 bushels corn in 1885; 7,128,371 bushels wheat in 1887; 5,337,732 bushels wheat in 1886. Shipments: Europe *via* New Orleans and river, 7,365,340 bushels corn in 1887; 7,501,730 bushels corn in 1886; 8,180,039 bushels corn in 1885; 3,975,017 bushels wheat in 1887; 743,439 bushels wheat in 1886; 50,000 bushels wheat in 1885.

Page 132.—Average rates of freight on wheat per bushel from Saint Louis to Liverpool:

Years.	Via New Orleans.	Via New York.	Years.	Via New Orleans.	Via New York.
	Cts.	*Cts.*		*Cts.*	*Cts.*
1882	$22\frac{3}{8}$	$23\frac{3}{8}$	1885	$15\frac{1}{8}$	$20\frac{1}{8}$
1883	$19\frac{7}{12}$	27	1886	$16\frac{1}{8}$	24
1884	$14\frac{7}{12}$	$21\frac{1}{2}$	1887	15	$24\frac{1}{8}$

Amount of freight either carried past or handled at various Lower Missouri River ports for the season 1887–'88.

Ports.	Wyoming.	Dacotah.	General Tompkins.	General Meade.	A. S. Willis.	D. H. Rucker.	Black Diamond.	Dick Clyde.	Jim Watkins.	Dora.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Saint Louis	8,344	9,228	1,980	1.500	......	438	......	......	......	......	21,371
Saint Charles	8,344	9,228	1,980	1,500	......	438	......	......	......	......	21,871
Portland	8,344	9,228	1,980	1,500	1,239	438	74	......	......	......	22,684
Saint Aubert	8,344	9,228	1,980	1,500	3,378	438	248	......	......	......	24,097
Barkersville	8,344	9,228	1,980	1,500	3,378	438	607	......	......	......	25,938
Osage River	8,344	9,228	1,980	1,500	3,960	438	1,620	......	......	......	26,951
Jefferson City	8,344	9,228	1,980	1,300	3,960	438	2,409	321	1,045	109	29,215
Claysville	8,344	9,228	1,980	1,300	3,960	438	293	321	1,045	......	26,990
Marion	8,344	9,228	1,980	1,300	3,960	438	293	321	1,045	......	26,990
Sandy Hook	8,344	9,228	1.980	1,300	3,960	438	87	270	687	......	26,375
Rocheport	8,344	9,228	1,980	1,300	5,061	438	......	270	687	......	27,389
Boonville	7,328	7,875	300	......	5,061	438	......	219	687	......	22,171
Arrow Rock	7,328	7,875	300	......	5,061	438	......	......	......	......	21,265
Lisbon	7,328	7,875	......	......	6,981	......	......	......	......	......	22,447
Glasgow	7,328	7,875	......	......	7,019	......	......	......	......	......	22,485
Kansas City	7,328	7,875	......	......	......	......	......	......	......	......	15,466

NOTE 1.—General Meade made eleven trips to Osage River during 1888; cargoes up were merchandise, and down, grain and stock. No estimates of amount obtained.

NOTE 2.—Steamer New Haven also ran to Chamois and New Haven with merchandise and returned with grain, but no estimates of cargoes were given.

Amount of freight either carried past or handled at Upper Missouri River ports for the season 1887-'88.

Ports.	Batchelor.	Helena.	Ste'mr Missouri.	Transfer No. 2.	Eclipse.	Rose Pud.	Benton.	General Tompkins.	General Terry.	Total.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*
Sioux City	150									150
Fort Pierre	150								45	195
Yankton	150							332	45	527
Standing Rock	365	260	80					332	185	1,222
Fort Yates	430	260	350	150	120	255	200	647	470	2,882
Bismarck	712	1,382	746	941	510	1,485	765	782	595	7,918
Washburn	227	1,120	366	760	390	1,160	500			4,523
Fort Berthold	227	1,120	310	760	390	1,160	500			4,497
Rocky Point	227	1,055	150	760	390	1,160	500			4,242
Fort Benton	227	755	150	760	390	895	500			3,677

Tons moved on the Lower Missouri River, 1887-'88.

	General merchandise.	Railroad ties.	Wheat.	Hogs.	Stock.	Lumber.	Nails.	Tobacco.	Wood.	Flour.	Produce.	Passengers (number).
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	
Wyoming	6,036	447	1,241	100	275	125	120					80
Dacotah	6,928	476	1,575	75				172				
General Tompkins	1,695		82		53						150	
General Meade	1,452		38								10	
A. S. Willis		7,019										
D. H. Rucker	100		338									
Black Diamond			153						2,207	49		
Dick Clyde			271			51						
Jim Watkins		970	75									
Dora						109						
Total	16,211	8,912	3,773	175	328	285	120	172	2,207	49	160	80

Tons moved on the Upper Missouri River, 1887-'88.

	General merchandise.	Wool.	Coal.	Hides.	Wool and hides.	Wheat and hides.	Flour.	Lumber.	Wheat.	Beer.	Soldiers.	Oats.
	Tons.	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Tons.*	*Cases.*	*Companies.*	*Tons.*
Batchelor	528			72				92		20		
Helena	1,230	150		2							5	
Steamer Missouri	546		200									
Transfer No. 2	575	140	150	76								
Eclipse	300	90	90					30				
Rose Bud	1,235	105		2½	70	70				2½	5	
Benton	450	140	100	75								
General Tompkins	305		215				60	40	72			90
General Terry	310	110	110	7½			50			7½	5	
Total	5,479	735	865	235	70	70	110	162	72	30	15	90

EXPENDITURES.

Office expenses, traveling expenses, and salaries of Commission.

[Appropriation act of July 5, 1884.]

July 1, 1887, amount available of above allotment		$13,133.15
Received from sales of fuel to officers		182.96
Unpaid liabilities June 30, 1887		75.93
Total		13,392.04
Itemized expenditures from July 1, 1887, to June 30, 1888, both dates inclusive:		
Office rent	$1,000.00	
Telephone	100.00	
Ice	27.00	
Awnings, and putting up the same	26.00	
Gas	11.40	
Water	20.00	
Fuel	653.41	
Mileage	733.76	
Traveling expenses	140.60	
Wages	8,027.54	
Transportation of employés	30.00	
Stationery	233.67	
Newspaper subscription	9.90	
Telegrams	3.95	
Transportation	13.68	
Office furniture	15.50	
Hardware	78.50	
Lumber	102.41	
Street sprinkling	22.00	
Material and labor	7.95	
Sundries	75.68	
Total	11,332.95	
Unpaid liabilities June 30, 1888	32.19	
		11,365.14
July 1, 1888, amount available		2,026.90

Additional surveys and establishment of permanent bench-marks below Sioux City.

[Appropriation act of July 5, 1884.]

July 1, 1887, amount available of above allotment		$618.94
Itemized expenditures from July 1, 1887, to June 30, 1888, both dates inclusive:		
Wages	$547.08	
Privilege of felling trees	68.00	
Stationery	3.86	
		618.94

Preservation and observation of gauges, and collection and compilation of physical data.

[Appropriation act of July 5, 1884.]

July 1, 1887, amount available of above allotment		$5,719.38
Unpaid liabilities June 30, 1887		17.33
		5,736.71
Itemized expenditures from July 1, 1887, to June 30, 1888, both dates inclusive:		
Wages	$5,272.00	
Traveling expenses	68.35	
Stationery	46.19	
Wire	15.65	
Brass plates	5.00	
Water-gauge rods	9.25	
		5,416.44
July 1, 1888, amount available		320.27

Special surveys (at Omaha, Atchison, Fort Leavenworth Reservation, Arrow Rock, Plattsmouth, Brownville, and Nebraska City).

[Appropriation act of August 5, 1886.]

July 1, 1887, amount available of above allotment		$2,505.74
Itemized expenditures from July 1, 1887, to June 30, 1888, both dates inclusive:		
Wages	$2,449.54	
Rope	6.30	
Stationery	31.05	
Zinc strips	3.60	
Gas pipe	3.15	
Privilege of felling trees	12.10	
		2,505.74

Elevations of extreme high water, Missouri River.

[These results, where different from those published, were determined by study of all data on the subject on file in the office of the Missouri River Commission February 15, 1888.]

Locality.	Miles above mouth of river.	Point of observation.	Elevation above Saint Louis City directrix.			Remarks.
			1844.	1881.	1883.	
			Feet.	*Feet.*	*Feet.*	
Saint Charles	25.1	Gauge and bridge	39.50	28.68	30.34	
Hermann	101.1	Gauge		91.79	92.54	
Jefferson City	145.8	....do		133.19	133.15	
Boonville	197.0	Gauge and bridge	184.80	175.41	175.39	
Glasgow	226.5	....do		201.45	202.77	
De Witt	262.5	Gauge			224.15	
Waverly	297.4	....do			252.45	
Lexington	319.3	....do		276.70	273.20	
Sibley	346.8	Bridge	310.959	303.859		
Randolph		....do		327.32	324.07	
Kansas City	386.3	Gauge and bridge	341.162	331.10	327.85	Nier, 334.2 (H. W. 1844).
Leavenworth	416.8	Gauge		352.97	349.59	
Fort Leavenworth	419.2	....do		356.77		Gauge to bridge = 1,600'. Slope = '.47 (H. W. 1881) H. W. 1867 = 351'.87.
Atchison	445.8	Gauge and bridge		376.51	371.40	
Saint Joseph	479.5	....do	400.62	403.32	398.92	
White Cloud	530.8	Gauge		438.82	436.92	
Rulo	542.0	Gauge and bridge				1885, H. W. 444.59—1887, 445.04.
Brownville	579.9	Gauge		481.94	478.40	
Nebraska City	608.5	....do		509.42	507.10	Bridge to gauge = 2,700'. Slope = +'.54 (M'n H. W).
Plattsmouth	639.2	....do		547.40	541.90	Gauge to bridge = 4,752'. Slope = 3' (H. W. 1881).
Omaha	667.8	Gauge and bridge		569.71	560.10	
O. & C. B. R. R	668.46	Bridge		569.97	560.36	Dist. to U. P. Br. = 2,850'. H. W. slope = '.26.
Blair	699.9	....do		594.14	585.42	
Sioux City	802.8	Gauge		686.34	677.15	Gauge to bridge = 10,000'. Slope = 1'.74.
Bismarck	1,427.3	Gauge and bridge		1,644.4	1,647.0	Morison's report.

Dates of ice closings and openings on the Missouri River, 1872–1887.

Locality.	1872–'73.		1873–'74.		1874–'75.		1875–'76.	
	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.
Sioux City								
Omaha		Mar. 10	Dec. 4	Mar. 19	Nov. 24	Mar. 30	Nov. 21	Mar. 31
Plattsmouth								
Nebraska City								
Brownville								
White Cloud								
Saint Joseph		Feb. 24				Mar. 23	Nov. 22[1] Jan. 11[2] Jan. 30	Jan. 15 Feb. 9
Atchison								
Leavenworth					Jan. 4	Mar. 18	Nov. 23 Jan. 31	Dec. 7 Feb. 9
Kansas City								
Lexington					Jan. 8	Mar. 10		
Waverly								
De Witt								
Glasgow								
Boonville						Mar. 10		
Jefferson City								
Saint Charles								
Saint Louis[3]	Nov. 29	Jan. 20	Open all winter.		Dec. 30	Feb. 27	Open all winter.	

Locality.	1876–'77.		1877–'78.		1878–'79.		1879–'80.	
	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.
Sioux City					Dec. 12[4]	Mar. 7	Dec. 8 Feb. 28	Feb. 24 Mar. 20
Omaha	Nov. 20 Mar. 7	Feb. 22 Mar. 15	Jan. 4	Feb. 14	Dec. 15	Mar. 9	Dec. 10 Feb. 3 Feb. 27	Jan. 26 Feb. 17 Mar. 1
Plattsmouth								
Nebraska City					Dec. 14	Mar. 5	Dec. 11 Mar. 15	Jan. 10 Mar. 18
Brownville								
White Cloud								
Saint Joseph	Dec. 1 Mar. 8	Feb. 10	Nov. 30 Jan. 4	Dec. 12 Jan. 19	Dec. 14 Mar. 20	Feb. 23 Mar. 24	Dec. 11 Jan. 30 Mar. 14	Jan. 8 Feb. 11 Mar. 20
Atchison								
Leavenworth	Dec. 20	Mar. 2			Dec. 17	Feb. 10		
Kansas City			Jan. 1	Feb. 3	Dec. 22	Feb. 4	Dec. 15	Jan. 4
Lexington					Dec. 27			
Waverly					Dec. 29[5]	Feb. 7		
De Witt								
Glasgow					Dec. 16	Feb. 10	Dec. 25	Feb. 3
Boonville	Dec. 7	Dec. 19			Dec. 26	Jan. 22	Dec. 28	Jan. 1
Jefferson City					Dec. 28			
Saint Charles						Jan. 26		
Saint Louis[3]	Dec. 8	Feb. 5	Open all winter.		Dec. 16 Feb. 14	Jan. 29 Feb. 17	Dec. 17	Dec. 31

Locality.	1880–'81.		1881–'82.		1882–'83.		1883–'84.	
	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.
Sioux City	Nov. 18	Mar. 26	Dec. 30	Mar. 1	Nov. 21	Mar. 13	Nov. 30	Mar. 22
Omaha	Nov. 21	Mar. 28	Jan. 2[6] Feb. 20	Feb. 11 Feb. 26	Dec. 7	Mar. 9	Dec. 30	Mar. 19
Plattsmouth		Mar. 24	Jan. 18	Feb. 11	Dec. 8	Mar. 4	Dec. 26	Mar. 16
Nebraska City	Nov. 21	Mar. 24		Feb. 10	Dec. 6	Mar. 4		Mar. 14
Brownville	Nov. 19	Mar. 24					Dec. 31	Mar. 13
White Cloud					Dec. 6	Mar. 2		Mar. 12

[1] Ice gorged 2½ miles above.
[2] Ice gorged at Belmont.
[3] Mississippi River.
[4] Ice gorged above. December 18 gorged below.
[5] Exact date of closing not given. Note said ice 10 inches thick.
[6] Gauge frozen up.

Dates of ice closings and openings on the Missouri River, 1872–1887—Continued.

Locality.	1880–'81.		1881–'82.		1882–'83.		1883–'84.	
	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.
Saint Joseph	....	Mar. 15	Nov. 21 Jan. 1 Feb. 21	Dec. 1 Feb. 6	Dec. 7	Mar. 3	Dec. 18 Jan. 2	Mar. 11
Atchison	Dec. 5	Mar. 15	Jan. 2	....	Dec. 7	Feb. 27	Dec. 23 Jan. 1	Mar. 10
Leavenworth	Dec. 5	Mar. 14	....	....	Dec. 17 Jan. 9	Dec. 19 Feb. 23	Dec. 31	Feb. 25
Kansas City	Nov. 24 Dec. 29	Dec. 8 Feb. 22	Dec. 29	Feb. 20	Dec. 4 Jan. 3	Dec. 11 Feb. 15	Dec. 19	Feb. 24
Lexington	....	....	....	....	Jan. 6	Feb. 16	Jan. 1	Feb. 23
Waverly	....	....	....	....	Jan. 5	Feb. 16	Jan. 1	Feb. 24
De Witt	....	....	....	....	Jan. 8	Feb. 16	Jan. 3	Feb. 1
Glasgow	Nov. 22	....	....	....	Dec. 9 Jan. 4	Dec. 21 Feb. 16	Jan. 2	Feb. 1
Boonville	....	....	Dec. 1	Dec. 8	....	....	Jan. 7	Feb. 1
Jefferson City	Jan. 22	Feb. 7	....	....	Jan. 31	Feb. 17	Jan. 6	Jan. 30
Saint Charles	Dec. 29	Feb. 12	....	....	Jan. 12	Feb. 15	Jan. 5	Jan. 31
Saint Louis[1]	Nov. 18 Dec. 7 Dec. 24	Dec. 5 Dec. 14 Feb. 15	Open all winter.		Dec. 7 Jan. 1	Dec. 23 Feb. 13	Dec. 18	Feb. 5

Locality.	1884–'85.		1885–'86.		1886–'87.	
	Closing.	Opening.	Closing.	Opening.	Closing.	Opening.
Sioux City	Nov. 22[2]	Mar. 13	Dec. 5	Mar. 23	Nov. 19	Mar. 11
Omaha	....	Mar. 10	Jan. 7	Mar. 17	Nov. 28	Mar. 10
Plattsmouth	....	Mar. 10	Jan. 7	Dec. 22 Mar. 17[3]	Dec. 25[4]	Mar. 12
Nebraska City	Dec. 18	Mar. 10	Dec. 7 Jan. 4	Dec. 27 Jan. 11 Mar. 17	Dec. 4 Dec. 27	Dec. 10 Mar. 9
Brownville	....	Mar. 10	Dec. 10 Jan. 8	Dec. 23 Feb. 23[5]	Dec. 3 Dec. 25	Dec. 10 Mar. 7
White Cloud	Dec. 19	Mar. 7	Dec. 14 Jan. 8	Dec. 21 Feb. 24	Dec. 3 Dec. 28	Dec. 10 Mar. 1
Saint Joseph	Nov. 25	Nov. 27 Mar. 12	Dec. 10 Jan. 6	Dec. 27 Feb. 24[6]	Nov. 29 Dec. 19	Dec. 10 Mar. 8
Atchison	Dec. 18	Mar. 8	Dec. 8 Jan. 8	Dec. 22 Feb. 22	Dec. 5 Dec. 28	Dec. 9 Mar. 5[7]
Leavenworth	Dec. 17	Mar. 6	Dec. 9 Jan. 5	Feb. 20	Dec. 4 Dec. 26	Dec. 10 Feb. 23
Kansas City	Dec. 22	Feb. 6	Dec. 13 Jan. 7	Dec. 22 Feb. 13	Dec. 4[8] Jan. 9	Dec. 10 Feb. 8
Lexington	Dec. 14[9] Feb. 10 Mar. 6	Feb. 6 Mar. 4 Mar. 9	Jan. 8	Feb. 18	Dec. 6 Dec. 27	Dec. 10 Feb. 8
Waverly	Dec. 18	Mar. 14	Jan. 8	Feb. 19	Dec. 5 Dec. 27	Dec. 11 Feb. 9
De Witt	Dec. 24	Mar. 5	Jan. 10	Feb. 17	Dec. 4 Dec. 25	Feb. 9
Glasgow	Dec. 21	Mar. 5	Dec. 16	....	Dec. 4[10] Dec. 29	Dec. 9[2] Feb. 7
Boonville	Dec. 19 Jan. 1	Mar. 5	Dec. 13 Jan. 8	Dec. 22 Feb. 18[11]	Dec. 30	Jan. 28
Jefferson City	....	....	Jan. 11	Feb. 14	Dec. 4 Jan. 1	Dec. 11 Jan. 24
Saint Charles	....	....	Dec. 11 Jan. 19	Dec. 25 Feb. 12	Dec. 31	Jan. 22
Saint Louis[7]	Dec. 19	Dec. 30[12]	Dec. 10 Jan. 7	Dec. 23 Feb. 16	Dec. 1 Dec. 24	Dec. 14 Jan. 27

---

[1] Mississippi River.
[2] Ice running.
[3] Ice broke up slowly (date approximate).
[4] December 2 ice gorged in west channel below gauge.
[5] Partial break up.
[6] Ice gorged and broke above bridge.
[7] Ice breaking and going out all week ending March 5, 1887.
[8] Ice closed at Quindaro.
[9] The exact date of closing not given. December 14 river was full of running ice, and on December 21 ice was 10 inches thick in channel.
[10] Closed 3 miles above.
[11] River full of floating ice.
[12] Also thirty-five days in January and February.

APPENDIX A 1.

REPORT OF SECRETARY ON PRECISE LEVELING.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., November 21, 1887.

SIR: I have the honor to report that the work of precise leveling between Saint Louis City Directrix and United States Engineer P. B. M. 17 of Missouri River (published list of 1881) has been completed by Mr. O. W. Ferguson, who had charge of the party.

It will be remembered that the Missouri River levels were based on P. B. M. 12 of the Mississippi River Commission, situated at the mouth of the Missouri River. The elevation of this P. B. M. 12 was given, at first, as $13^{m}.2824$ above Saint Louis City Directrix. On this the published Missouri River elevations were calculated. In March, 1886, it was discovered that the elevation of P. B. M. 12, as finally determined and published in Annual Report of Mississippi River Commission for 1883, was given as $13.^{m}3869$, a difference of $+\left\{\begin{matrix}0^{m}.104\\0^{f}.341\end{matrix}\right\}$

From that time to date this $+0'.341$ has been adopted as the proper correction for all the Missouri River elevations.

The line of precise levels now completed had for its object a direct check on the elevation of Mississippi River Commission, P. B. M. 12 above Saint Louis City Directrix, and as a result the determination of the constant correction, if any, to be applied to the published Missouri River elevations.

The results are shown on the table appended.

From an examination of the table it will be seen that the constant correction to be applied to the elevations on the Missouri River as published is $+0'.300$ instead of $+0'.341$.

It should be borne in mind that this $+0'.300$ error is not to be charged to the level work done on the Missouri River.

The last column of the table gives the corrections for the Missouri River due to instrumental and other field work errors for the work between the mouth of the river and Saint Charles; and when it is remembered that the wye level alone was used on the Missouri River, the figures referred to are an indorsement of the opinion expressed in the Annual Report of the Commission for 1886, that the elevations as determined along the Missouri River are quite reliable.

It is proposed to publish, as soon as may be, a correct list of Missouri River elevations.

Very respectfully, your obedient servant,

THEO. A. BINGHAM,
First Lieutenant of Engineers, U. S. Army,
Secretary Missouri River Commission.

Lieut. Col. CHAS. R. SUTER,
Corps of Engineers, U. S. Army,
President Missouri River Commission, Saint Louis, Mo.

P. B. M. (1^{m}=3'.280869).	Determination of elevation from Saint Louis City Dir., 1887 (+ above; — below).	Mississippi River.		Missouri River.		
		Ann. Rep. M. R. C. published elevations from Saint Louis City Dir., 1883.	Correction to make 1883 published elevation agree with 1887 determination.	Published elevations, 1881.	Correction to make 1881 published elevation agree with 1887 determination.	Errors of 1881 published elevation with constant error +0'.300 applied.
Saint Louis City Directrix,	0.00	0.00	0.00	0.00	0.00	
U. S. C. S. B. M*	+ 0^{m}.0053					
	+ 0'.01739					
30' mark, water gauge at Saint Louis.	— 1^{m}.1285	— 1^{m}.1411	+0^{m}.0126			
	— 3'.70246	— 3'.74380	+0'.04134			
M. R. C. P. B. M. 15	+ 0^{m}.8144	+ 0^{m}.8196	—0^{m}.0052			
	+ 2'.67194	+ 2'.68900	—0'.01706			
80' mark, river gauge at Wat. Wk's, Saint Louis.	— 3^{m}.4820	— 3^{m}.4998	+0^{m}.0178			
	—11'.42399	—11'.48234	+0'.05835			
M. R. C. P. B. M. 14	+ 3^{m}.8325	+ 3^{m}.8459	—0^{m}.0134			
	+ 12'.57393	+ 12'.61790	—0'.04397			
M. R. C. P. B. M. 13	+ 5^{m}.3488	+ 5^{m}.3705	—0^{m}.0217			
	+ 17'.54872	+ 17'.61990	—0'.07118			
M. R. C. P. B. M. 12	+ 13^{m}.3739	+ 13^{m}.3809	—0^{m}.0130			
	+ 43'.87801	+ 43'.92067	—0'.04266	+43'.578	+ 0'.30001	0.0000
Missouri River P. B. M. 6	+ 5^{m}.9328					
	+ 19'.46474			+19'.142	+ 0'.32274	+ 0'.0227
Missouri River P. B. M. 7	+ 5^{m}.4821					
	+ 17'.98605			+17'.664	+ 0'.32205	+ 0'.0220
Missouri River P. B. M. 8	+ 1^{m}.2833					
	+ 4'.21034			+ 3'.856	+ 0'.35434	+ 0'.0543
Missouri River P. B. M. 9	+ 7^{m}.6443					
	+ 25'.07994			+24'.701	+ 0'.37894	+ 0'.0789
Missouri River P. B. M. 11	+ 7^{m}.6472					
	+ 25'.08945			+24'.683	+ 0'.40645	+ 0'.1064
Missouri River P. B. M. 15	+ 7^{m}.7391					
	+ 25'.39098			+24'.979	+ 0'.41198	+ 0'.1120
Missouri River P. B. M. 17	+ 9^{m}.2074					
	+ 30'.20827			+29'.827	+ 0'.38127	+ 0'.0813
					Mean..	= 0'.0682

* Letter of January 30, 1886, says it is at same level as City Directrix.

APPENDIX A 2.

Descriptions and elevations of bench-marks on the Missouri River, referred to Saint Louis City directrix, May, 1888.

[List of bench-marks No. 1 was issued 1881–'82. This list is No. 2. It is corrected by all data on file up to date. Its elevations were determined by wye levels, except the following, which are precise level determinations: 6 (12)—7 (11)—8 (10)—9 (9)—11 (7)—15 (3)—17 (1)—Each bench-mark has two numbers. The one in parenthesis is the one in the note books; the other is that of the complete old series reckoning from the mouth up. A new series is in progress. The new bench-marks are placed on lines generally straight across the valley, these lines being about 5 miles apart. The designations of the new bench-marks are in the form of a fraction, the numerator being the number of the line reckoning from the mouth up; the denominator being the number of the bench-mark in that line reckoning from the right bank. All elevations refer to the Saint Louis City directrix, which is 433.97 feet above the Cairo datum and 412.71 feet above the Mississippi River Commission 1881, determination of mean Gulf tide at Biloxi, Miss.]

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
1 (17) Mouth Missouri River.	Equals P. B. M. 12 of Mississippi River Commission: "top of copper bolt in stone in ground in corner of woods, 20 meters west of Columbia Road, 800 meters from river, 9 miles above Saint Louis water-works, on land owned by ——— Chambers"	43.878	
2 (16)	On east side of 1.5-foot elm, in woods behind willow bar, 140 feet west of high bank, 2,200 feet south of mouth of Missouri River	9.184	
3 (15)	Equals "B. M. 80" of 1879: on east side of 2.5-foot sycamore on edge of high bank behind willow bar, 520 feet south of Missouri River	6.370	
4 (14)	On northwest side of 4.5-foot sycamore, 600 feet from river, 200 feet north of 1½-story frame dwelling of Christ. Hurstmann, on south side of a small clump of timber 1½ miles above mouth of river, vicinity of P. 521	7.185	1.5

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
5 (13)	On west side of 3.2-foot sycamore, 900 foot from river, 400 feet from edge of high bank, 30 feet east of fence line between fields, one-fourth mile below foot of island tow-head, 2¾ miles above mouth of river; vicinity of P. 517	11.154	2.7
6 (12)	On 1.9-foot black oak, on side of bluff, 70 feet from river, one-half mile below mouth of creek at site of Fort Belle Fontaine	19.465	5.3
7 (11) Jamestown.	Equals "B. M. 79" of 1879; on 2.5-foot cottonwood, on lower side of ravine at Jamestown Landing	17.986	7.3
8 (10)	Horizontal furrow in head of copper bolt leaded into northwest exposure of hard limestone ledge, about 500 feet below foot of island tow-head, 780 feet above fence, 2,900 feet above Jamestown Landing	4.210	7.8
9 (9)	On 1.6-foot pignut hickory, in field on side of bluff, 150 feet from river, at lower end of small bottom, 2 miles above Jamestown Landing; vicinity of △ 920½	25.080	9.3
10 (8)	On 3.1-foot cottonwood, on edge of high water bank, behind willow and cottonwood flat; opposite head of small island tow-head, one-half mile below foot of Pelican Bar; vicinity of sounding stake A 175.	17.071	10.9
11 (7)	Horizontal furrow in head of copper bolt leaded into hard limestone ledge, on south side of wagon road, and 4.5 feet above its level, 220 feet below lower end of stone quarry, 1,200 feet below Hall's or Music's ferry	25.089	14.9
12 (6)	On north side of 2-foot burr oak, 170 feet from river, on line between woods on west and fields on east, one-quarter mile above small island willow tow-head, 1½ miles above Hall's Ferry	19.775	16.4
13 (5) Charbonnier.	On west side of 2-foot elm, 120 feet from river, on west side of clump of timber 1 mile below Charbonnier Bluff, and about one-quarter mile below head of Charbonnier Island	23.374	18.5
14 (4)	On west side of 3.3-foot cottonwood, 120 feet from river, 215 feet south of 1½-story frame dwelling of Louis Knapp. The tree stands in lane, 500 feet above Charbonnier Bluff	24.392	19.8
15 (3)	On 1.2-foot black oak, on east side of wagon road, 40 feet from edge of high-water bank, 1 mile from edge of shore bar, about 1 mile above Charbonnier Bluff	25.391	20.7
16 (2)	On northwest side of 1.6-foot cottonwood, 150 feet from edge of high-water bank, in cottonwood timber, opposite or a little way above head of Holme's Island, about 1 mile from edge of shore bar, 3 miles below Saint Charles Bridge	22.637	22.1
17 (1) St. Charles.	Horizontal furrow in head of copper bolt leaded into northwest side of seventh pier from Saint Charles end of bridge at Saint Charles, Mo	30.208	25.1
17 (a)	Gauge B. M.—A cross (+) cut on top of horizontal surface of projecting rock, on first course of masonry above ground, on southwest corner of Pier No. 1 (counting from left bank), of Saint Charles Bridge, at Saint Charles, Mo	28.691	....
	"B. M. 77" of 1879—on southwest corner of offset course of west column supporting trestle—first column west of west pier, Saint Charles Bridge	35.805	....
	"B. M. 78" of 1879. Top of foundation-course at northeast corner of 2½-story brick, on southwest corner of Second and Wood streets, Saint Charles, Mo	39.568	....
18 (157)	On 3.3-foot sycamore, westward one of a pair standing 100 feet from river, midway between △'s 884 and 886	29.261	27.4
19 (156)	On 2-foot maple, 30 foot from foot of bluff, 125 feet from bank, at point of bluff nearest river, just above △ 882	29.715	28.6
20 (155)	On 1.4-foot cottonwood, on south side of dry chute, 1,500 feet below △ 870	34.752	32.8
21 (154)	On 1.7-foot elm, 80 feet from river, 225 feet above △ 866	38.593	34.1
22 (153)	On 2.5-foot cottonwood, 20 feet from bank, at landing near △ 862, opposite middle of Catfish Island	39.554	36.3
23 (152)	On 8-inch sycamore, 300 feet from river, opposite △ 863, 1,800 feet below △ 858; opposite foot of Bonhomme Island	35.896	39.2
24 (151)	On 2.5-foot box alder, standing alone in a cultivated field, 350 feet from river, 2,250 feet below △ 856	47.632	40.8
25 (150)	On 1.7-foot pignut hickory, 150 feet from bank, 1,000 feet south from house, 300 feet above △ 854	45.075	41.3
26 (149) Cottleville.	On 1.9-foot black walnut, one-quarter of a mile west from house of Ernest Kroenig, 250 feet from river, about opposite Cottleville Landing	47.912	43.8
27 (148)	On 2-foot elm, 300 feet southwest from house of William Walter, one-quarter of a mile from river, about opposite R. B. ⊙ 649	54.504	46.1
28 (147)	On 3.3-foot maple, 100 feet from river bank, on bank of ditch or dry creek, opposite Howell's Island	46.723	47.9
29 (146)	On 1.9-foot linn, 120 feet from river, at foot of bluff, 400 feet below lowest point of rock bluff above Howell's Island	53.938	48.9
30 (145)	On 1.7-foot sycamore, at mouth of dry branch, in gully at △ 840	46.144	51.1
31 (144)	Horizontal furrow in head of copper bolt leaded into vertical face of rock 600 feet above Tavern Rock, and 20 feet above large crag leaning against cliff	41.677	52.1

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
32 (143) St. Albans.	On 1.5-foot linn, 40 from river, 300 feet below first point of bluff below Saint Albans, Mo	56.747	53.3
33 (142)	On 1.7-foot oak, in recess between bluffs, known as "Eddy Hollow," under main bank, just below △ 834	53.746	54.7
34 (141)	On a doubled and twisted white walnut, 2.5 feet in diameter, in gully just above △ 832	67.208	56.4
35 (140)	On 1-foot cottonwood, on east bank of dry slough, 500 feet north from house, vicinity of △ 830	54.153	58.7
36 (139) Augusta.	On 1.5-foot cottonwood, 900 feet from river, standing alone in wheat field just opposite Augusta, Mo	59.406	61.2
37 (138)	On 2-foot black oak, 200 feet from river in grove about three-fourths mile above △ 828, 200 feet below fence corner, 1,500 feet above farm house	59.197	62.4
38 (137)	On 3-foot box alder, 2,500 feet below △ 826, 250 feet from river, in field owned by ——— Hinkle	63.240	63.7
39 (136)	On 1.2-foot hackberry, 200 feet from river, 150 feet below fence between wheat field and first timber below South Point, Mo	63.271	65.0
40 (135)	On 1-foot white walnut 100 feet south from railway, in glade, one-half mile above section house, 1½ miles below South Point, Mo	74.946	65.9
41 (134) South Point.	Horizontal furrow in head of copper bolt leaded into face of cut rock, about 1,000 feet above depot at South Point, Mo	76.550	67.6
42 (133)	On 1.5-foot elm, 20 feet south from railway, by spring, about 1 mile below Washington, Mo	73.242	68.6
42 (*a*)	T. B. M. 3′, on corner of red sandstone, top layer of west abutment, river side of open culvert "No. 14*a*" of Missouri Pacific Railroad, about seven-eighths of a mile above Washington, Mo., railroad station-house	76.584	....
Washington.	"B. M. 75" of 1879; northeast corner of door-sill of Elm street entrance of two-story brick building on northwest corner of Water and Elm streets, Washington, Mo	83.873	69.6
	"B. M. 74" of 1879; northwest corner water-table of three-story double brick, on southeast corner of Water and Elm streets, Washington, Mo	82.587	....
43 (132)	On 2.1-foot sycamore, on main bank, 300 feet from chute, 200 feet from railway, 1½ miles above Washington, Mo	68.814	71.9
43 (*a*)	T. B. M. 5, on extreme southwest corner of large cut stone used for bearing for the west end of the south iron plate girder of the Missouri Pacific Railroad iron bridge over the St. John's Creek, about 2½ miles from Washington, Mo	80.852	72.2
43 (*b*)	T. B. M. 5′, is a point within the upper loop of the "B" of the railroad "B + M," cut in the upper surface of the south end of the west abutment of the iron bridge "No. 15," over the St. John's Creek, Missouri Pacific Railroad, 2½ miles above Washington, Mo.	78.838	72.2
44 (131)	One 10-inch cottonwood, 50 feet southwest from reference tree of △ 812	70.143	75.0
45 (130)	Mark "O" cut on northwest corner of top of riverward wall of culvert 2 miles below Newport, Mo	80.372	76.3
46 (129) Newport.	On 2.3-foot oak, 300 feet south from railway, on west side of bluff, 2,000 feet below Newport, Mo	98.286	77.8
46 (*a*)	T. B. M. 10, is a ‾‾‾| chiseled on the southeast corner of the top coping stone, east end of land-side wall of the arched culvert of the Missouri Pacific Railroad over the "Little Bœuf" Creek, 300 feet above Dundee, Mo., station-house	87.738	78.2
46 (*b*)	T. B. M. 10′, is a |___ chiseled on the southwest corner of west end stone of coping stone on retaining-wall east side creek, landward side of arched culvert over the "Little Bœuf" Creek, 300 feet above Dundee, Mo., station-house	81.602	....
47 (128)	On northeast corner of top of east abutment of railroad bridge No. 16, 1 mile above Newport, Mo	87.200	79.4
48 (127)	Horizontal furrow in head of copper bolt set into cut rock at head of chute or cut off above Newport, Mo	94.549	....
49 (126)	On northeast corner of west abutment of bridge 1½ miles below New Haven, Mo	88.911	82.9
50 (125) New Haven.	On northeast corner water-table of 3-story brick store of New Haven Merchandise Company, New Haven, Mo	96.546	84.7
51 (124)	On northeast corner northwest wing-wall of Missouri Pacific Railroad culvert, 150 feet above head of willow bar, at △ 796	92.572	86.5
52 (123)	On 3.2-foot elm, on main bank, behind willow bar, near △ 794 and railroad station Etlah	83.026	88.4
53 (122) Hoehn's Landing.	On 2-foot elm, 200 feet from river in field, at head of long willow bar, 2,000 feet above △ 792, at Hoehn's Landing, Mo	89.255	90.7
54 (121)	On 3-foot sycamore, 300 feet from river, at eastern edge of timber, 1,200 feet above △ 790	88.160	92.0
55 (120)	On 1.7-foot elm, on bench, midway between R. B. ⊙'s 467 and 468	86.848	93.2
56 (119)	On 1.7-foot elm, 200 feet from river, about 1,500 feet below △ 786, in first woods below Bates' Island	86.711	94.5
57 (118) Bates Island	On 10-inch sycamore, 30 feet from railway, at base of bluff, 1,500 feet west from house of August Gatsmeier	103.006	97.1

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
58 (117)	On 1.3-foot black walnut, at point of bluff above recess in bluffs, just above head of Bates' Island Chute	102.434	99.6
59 (116) Hermann	Horizontal furrow in head of copper bolt leaded into rock at end of railroad cut entering Hermann, Mo., from above	103.502	101.1
	"B. M. 72" of 1879—on northeast corner of the coping of the head wall of the west abutment of bridge, 200 feet east of depot at Hermann, Mo. [*Doubtful.*]	99.278	....
	"B. M. 71" of 1879—on northeast corner of water-table of three-story brick hotel known as the "White House," at Hermann, Mo	106.434	....
60 (115)	On 2.5-foot elm, eastward one of a pair standing between railway and river, 1½ miles above Hermann, Mo	97.282	102.1
61 (114)	Mark—"⌓" cut into top of second course of rock, north and east abutment, bridge No. "20," Missouri Pacific Railroad	106.660	104.4
62 (113)	On stump of cluster of 4-inch elms at base of bluff, 800 feet below △ 762	118.923	105.9
63 (112) Gasconade River.	Horizontal furrow in head of copper bolt set into face of cut rock at side of Missouri Pacific Railroad, 3,000 feet below Gasconade Bridge.	115.885	107.3
64 (111)	On 1.9-foot elm, 150 feet southeast from pink house of G. Haeck, between △'s 756 and 758	97.801	109.1
65 (110)	On 3-foot elm, 300 feet from river by fence, just behind house, near △ 754	100.353	110.5
66 (109) Bluffton.	On 1.7-foot elm, 500 feet from river, at edge of woods, 300 feet below fence corner, on place of Henry Tay, near △ 752	102.679	112.0
67 (108)	On 1.7-foot cottonwood, 40 feet from river, 60 feet from road, one-quarter mile above head of island above Bluffton, Mo., about 1,000 feet above △ 748	101.415	114.4
68 (107)	On 1.7-foot elm, 100 feet from chute, midway down Portland Island	106.159	115.3
69 (106) Portland	On 1.3-foot cottonwood, 400 feet from chute, on south side of dry slough opposite head of Portland Island; at △ 740	104.608	116.8
70 (105)	On 1.5-foot cottonwood, 150 feet from river, about 2 miles below Chamois, Mo., vicinity of △ 736	106.587	118.0
71 (104)	On 2.3-foot sycamore, 200 feet from river, 100 feet below field on right bank of dry slough, about 4,500 feet below Chamois, Mo	109.455	120.4
72 (103)	On 2.5-foot cottonwood, in field 500 feet northeast from house of Louis Reifsteak, and 300 feet from river	108.530	....
73 (102)	On twin cottonwood, 2 feet in diameter, 400 feet from river, 300 feet west from house of W. M. Prier, on the Huston place, half-way between Saint Aubert and Chamois	106.901	123.8
74 (101)	Horizontal furrow in head of copper bolt leaded into rock, south side east abutment, bridge No. 24, Missouri Pacific Railroad, 1 mile below Saint Aubert Station	116.009	125.6
75 (100) Saint Aubert.	On southwest corner top of rock base of northeast corner post of bridge No. 26, Missouri Pacific Railroad	125.038	126.6
76 (99)	Mark "□"—cut in top of rock at southeast corner of north abutment of bridge No. 27, Missouri Pacific Railroad	129.802	....
77 (98)	On 1.9-foot cottonwood, on bank just in front of depot at Isbell Station, Missouri Pacific Railroad	122.230	130.5
78 (97)	Mark "□"—cut into top of rock at southwest corner east abutment of culvert, 600 feet from river, and 2 miles below Bonnot's Mill, Mo.	125.382	132.5
79 (96) Bonnot's Mill.	On 3.3-foot elm, 50 feet north from Missouri Pacific Railroad, 1,000 feet below Bonnot's Mill depot	119.214	134.5
80 (95)	"U. S." cut into top of rock base of northeast corner-post of bridge No. 29, Missouri Pacific Railroad	130.731	....
81 (94)	"U." cut into top of rock base of southwest corner-post of bridge No. 29, Missouri Pacific Railroad	130.666	....
82 (93)	Horizontal furrow in head of copper bolt set into cut face of rock, 250 feet from river, and 200 feet above bridge No. 30, Missouri Pacific Railroad	148.732	135.2
83 (92) Osage River.	On 1.3-foot black walnut, 25 feet from river, at mouth of Osage River, lower side	122.277	137.3
84 (91)	On southwest corner east abutment bridge No. 32, Missouri Pacific Railroad	139.432	....
85 (90)	On 2-foot oak, 50 feet from river, and 50 feet from upper bank of Moreau Creek	130.711	141.3
86 (89)	On 1.5-foot sycamore, on south bank of cut, 900 feet below tunnel, 4 miles below Jefferson City, Mo., opposite mile post 121 miles from Saint Louis, Mo	173.969	141.8
87 (88)	On northwest corner of east abutment of small bridge above P. 155, about at R. B. ⊙ 248	140.707	142.5
88 (87)	On southwest corner of coping of east abutment of small bridge 7,000 feet below capitol building of Missouri	140.867	144.7
Jefferson City.	"B. M. 70" of 1879—top of lower step at northeast corner of northeast wing wall of first culvert below passenger depot at Jefferson City, Mo	134.343	....
89 (86)	Equals "B. M. 69" of 1879—top of lower step at northwest corner of northwest wing wall of first open culvert below passenger depot at Jefferson City, Mo	136.163	145.5

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
....	Gauge B. M.—east end of east door-sill of Lohman's warehouse, foot of Jefferson street, Jefferson City, Mo	141.796	....
89 (85)	Horizontal furrow in head of copper bolt leaded into rock of river-ward cut face of Capitol Hill, Jefferson City, Mo	143.536	145.9
90 (*a*)	Gauge B. M. "C."—Knob cut on projection of rock about .2 foot below top of eleventh course of masonry, counting from top, 20 feet east of foot of arch, in north face of Missouri Pacific Railroad culvert, at Jefferson City, Mo	128.078	....
90 (*b*)	Gauge B. M. "P. H."—Knob cut on projection of rock ledge, about 2 feet above ground, in an old cellar about 100 feet west of old pork house, and about 50 feet north of Missouri Pacific Railroad track, Jefferson City, Mo	131.490	....
91 (84)	On shelf in cut rock, 10 feet from Missouri Pacific Railroad, one-half mile below Gray's Creek. [*Indefiniteness of location probably renders this B. M. valueless*]	148.977	....
92 (83)	On 2-foot sycamore, in old roadway, 120 feet from bluff, about one-quarter mile above site of △ 680	133.940	150.7
93 (82) Claysville.	On 1.7-foot oak, at fence between cornfield and woods, next bluff, near lower end of "Gale Farm," opposite Claysville, Mo	136.508	152.8
94 (81)	On 1.3-foot twin hackberry, in north and south fence row, 250 feet from bluff, one-quarter mile from chute behind Stanley Island, 1½ miles above Claysville, Mo	140.609	155.0
95 (80)	On 1.3-foot elm, 8 feet from river, 300 feet below △ 670	143.560	156.5
96 (79)	Horizontal furrow in head of copper bolt leaded into rock 300 feet above end of reach of bluffs extending from Sugar Loaf Rock down stream	136.907	158.0
....	B. M. on knob cut on outermost point of Sugar Loaf Rock	138.148	158.7
97 (78)	On 1.5-foot oak, 350 feet from river, 1,500 feet above mouth of creek, 1½ miles below Marion, Mo	140.993	160.0
98 (77) Marion	Equals "B. M. 67" of 1879—on 2.5-foot sycamore, 50 feet from river, near turn in road, one-quarter mile below Marion, Mo	143.561	161.1
99 (76)	On 1.3-foot cottonwood, 100 feet from river, near site of △ 660	143.919	162.9
100 (75)	On 1.5-foot sycamore, on slope of bench, behind wooded sand-bar, 300 feet from river, and 1,300 feet below △ 656	145.103	165.0
101 (74)	On 3-foot oak, leaning westward, 300 feet from river, on bank of Factory Creek, one-half mile above Jamestown Landing, Mo., about 1,000 feet above △ 652	150.062	167.0
102 (73)	On 1.5-foot sycamore, 250 feet from river and U. S. light, in cornfield one-quarter mile below mouth of chute; 700 or 800 feet below △ 650.	153.812	167.5
103 (72)	On 6-inch willow, 40 feet from chute, 4,500 feet above its mouth, which is 1,000 feet below △ 644	147.808	168.8
104 (71)	On 4-foot cottonwood, 600 feet southeast from house of Richard Bruce, 6,000 feet south from Bruce's Landing, head of Nashville Island	151.799	171.5
105 (70) Providence	On 1.5-foot hackberry, 100 feet from river, about 1,000 feet above △ 640, and three-quarters mile above Providence, Mo	155.771	172.8
106 (69)	On 1.5-foot black walnut, on south side of road, 25 feet west from turn in road, 250 feet from river, and three-quarters mile below Wolfe's Point	159.658	174.2
107 (68)	On 1.7-foot red oak, on bank at base of bluff, one-half mile above Big Splice Creek, near △ 632	161.393	175.1
108 (67)	On 5.9-foot cottonwood, in field at base of bluff, 1,000 feet below Petit Saline Creek	157.327	177.0
109 (66)	On 4-foot cottonwood, 200 feet from river, 300 feet northeast from house of H. L. Forsythe; 2,000 feet above △ 624	159.500	178.3
110 (65)	On 2.5-foot elm (very high), at roadside, 200 feet from chute, and 400 feet west from house of A. Rimel, three-quarters mile above foot of Terrapin Island	166.319	180.0
111 (64)	On 3-foot cottonwood, at roadside, 6,000 feet south from B. M. 112	162.104	181.1
112 (63)	On elm, at roadside, 1,500 feet from river, near house of James Powell, about opposite head of Terrapin Island	163.173	182.9
113 (62)	On sycamore, at roadside, 250 feet from river, at site of △ 610	165.390	184.0
114 (61)	On 2-foot honey locust, 150 feet from river, in front of R. H. Walker's house, 1,000 feet below △ 606	161.151	185.2
115 (60) Rocheport.	On 4-foot elm, 500 feet from river, 800 feet west from house of John Walker, about 1,800 feet above △ 600, one-half mile above Overton, opposite Rocheport, Mo	171.576	188.3
116 (59)	On 3-foot red elm, in field, 200 feet west from north and south road, about 600 feet from river, near site of △ 596	168.318	189.7
117 (58)	On 1.2-foot sycamore, 15 feet from the river, at mouth of creek, where bluffs leave river, 2 000 below △ 592	168.812	190.3
118 (57)	Horizontal furrow in head of copper bolt leaded into face of rock on bluff side, on lower side of recess in bluffs, in which stands an old stone mill, 3,000 feet below foot of Franklin Island, and near site of △ 588	181.233	192.9
119 (56)	On 3.3-foot cottonwood, on bank, one-half mile above the foot of Franklin Island	167.797	194.0
120 (55)	On 1-foot cottonwood, at base of rock bluff, 150 feet from chute, 20 feet from vertical rock, 1½ miles below Boonville, Mo	170.091	195.2

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
....	"B. M. 63" of 1878—on top of stone on west side of Main street, between Levee and Alley, marking high water of 1844, Boonville, Mo.	*Feet.* 185.153	*Miles.* 197.0
....	H. W. of 1844 at Boonville, Mo	184.800	......
Boonville.	"B. M. 62" of 1878—northwest corner, stone door sill at northwest entrance to two and one-half story brick warehouse on east side of Main street, fronting on Levee, at Boonville, Mo	177.854	197.0
121 (54)	Horizontal furrow in head of copper bolt leaded into face of south abutment of Missouri, Kansas and Texas Railroad bridge, Boonville, Mo	172.988	197.4
122 (53)	On 4-foot cottonwood, on bank, 1,000 feet above brewery above Boonville, Mo	176.572	198.1
123 (52)	On 1.9-foot sycamore, on bank at foot of hills, 2,000 feet below △ 576, about 2¼ miles above Boonville, Mo	177.743	199.6
$\frac{41}{1}$ Boonville.	On right bank, about 2¼ miles above Boonville bridge, half a mile below old coal bank and creek, 200 feet below Little Creek, in little pocket in bluff, 30 feet from the river bank	183.540	199.8
$\frac{41}{2}$	On left bank, 6,661 feet north of $\frac{41}{1}$, in bottom, half a mile from river, in north fence of east and west road, in front of T. L. Tensley's house, one-eighth of a mile west of quarter section corner, on east side Sec. 2, T. 48, R. 18	178.468	......
124 (51)	On 2.5-foot elm, 150 feet from river, at mouth of small stream, 1,500 feet above △ 570	178.650	200.8
125 (50)	On 2-foot black walnut, 100 feet from river, at mouth of creek, about 1,500 feet below △ 568	184.926	201.7
126 (49) Lamine River.	On 1-foot twin elm, 35 feet from river, 1,000 feet below Lamine River.	182.519	202.6
$\frac{42}{1}$ McMahon Creek.	On right bank, at foot of bluff, 1⅝ miles above "General Ashley's Grove," on lower edge of McMahon Creek bottom, 500 feet from mouth of creek, 200 feet from the right bank of "Slaughter House Chute," 6 feet from rock ledge (about 20 feet high) where it slopes down to back side of spur	181.441	204.4
$\frac{42}{2}$	On left bank, half a mile from river, and about 1,200 feet east of Frank Blankensbaker's two-story frame house, 1,400 feet northeast from school-house, District No. 7, in center of fence, about 300 feet south of bench, 3 or 4 feet high, and sloping to the north	179.658	......
$\frac{42}{3}$	Is half a mile from $\frac{42}{1}$, near turn in road or lane running northeast, about half a mile from swamp, 40 feet toward river from house, on high bench running east and west, about 70 feet north of south fence of road prolonged through field and land owned by F. Blankensbaker	181.590	......
127 (48)	On 4.1-foot sycamore, 300 feet from Slaughter House Chute, at mouth of Moon Branch, 150 feet from bluffs, 2,000 feet above mouth of chute	183.422	204.5
128 (47)	On 1.7-foot black walnut, 200 feet from right bank of Slaughter-House Chute, at end of timber just below head of said chute	183.461	206.4
129 (46)	On 3-foot linn, in belt of timber on Harrison farm, about 2,000 feet southwest from mouth of chute behind Arrow Rock Island	189.400	206.8
130 (45)	On 2-foot elm, in field, 200 feet from Arrow Rock Island Chute, 2,000 feet from foot of bluffs, 5,000 feet above mouth of chute at △ 556	190.533	207.8
131 (44)	On 3.4-foot sycamore, in corn-fields, 1,800 feet below △ 552, 150 feet from chute	184.817	209.6
$\frac{43}{1}$ Arrow Rock.	On right bank, about 1¼ miles below Arrow Rock, Mo., and about 200 feet above Slough Creek, on foot of bluff, 150 feet from point where bluff turns up the creek valley, about 100 feet toward river from rock ledge in hollow in bluff, 10 feet from foot of slope	196.746	209.6
$\frac{43}{2}$	On left bank, one-half mile from river, in middle of bottom, in north fence of east and west road, 730 feet east of northwest corner Sec. 14, T. 49, R. 18, Howard County, Mo., in front of and opposite side of road from J. A. Fisher's two-story frame house	184.142	......
$\frac{43}{3}$	On left bank, at foot of bluff, 4,390 feet northeast from $\frac{43}{2}$, and about 2,000 feet north of school-house, district No. 4, in recess of bluff, about 275 feet southeast from John Step's log-house, 230 feet east from road, in fence 30 feet from foot of bluff slope, 430 feet north of Fairbanks weighing scales	204.309	......
	"B. M. 61" of 1878—top of hole drilled in rock at △ 550	178.043	210.8
132 (43) Arrow Rock.	Horizontal furrow in head of copper bolt leaded into point of rock at Arrow Rock Ferry Landing	183.843	211.2
133 (42)	On 3.8-foot cotton-wood, at roadside, 1,100 feet south from house of J. Craig, about 2 miles above Arrow Rock, Mo	188.444	213.2
44 1 Lisbon.	At foot of bluff, on right bank of river, nearly opposite the town of Lisbon, Mo. It is between two creeks, which come out of the bluff, 500 feet below the upper and about 1,100 feet above the lower one, 300 feet southeast from J. W. Leeper's log-house, and 500 feet northeast of J. A. Leeper's log-house, both on bluff, 6 feet in front of highest point (16 feet high) of rock ledge, which crops out about 200 feet	184.723	214.4

Descriptions and elevations of bench-marks on the Missouri River, etc.—**Continued.**

No.	Description.	Elevation.	Above the mouth.
$\frac{44}{2}$	Is on right bank, 7.774 feet west of $\frac{44}{3}$, in west fence of north and south road, about 1,880 feet north of Hugh Craig's two-story white frame house. Is 630 feet south of northwest corner Sec. 19, T. 50, R. 18..	*Feet.* 182.284	*Miles.* ....
$\frac{44}{3}$	On left bank, one-half mile below Lisbon, Mo., in woods, 133 feet above (up-river) corner of fence—probably east and west fence between Secs. 25 and 26, in little pocket in bluff, in mouth of "draw" between road and river, 30 feet from road and 20 feet from river...	200.279	....
134 (41)	On 1.7-foot elm, 3,000 feet from river, at a point 9,000 feet below Saline City, on county road across point to Arrow Rock, Mo	187.683	216.3
135 (40)	On 2.5-foot chincapin oak, one-quarter mile from river, 250 feet south from house of Simon Diggs, 1½ miles below Saline City, Mo	191.519	215.6
136 (39	On 2.2-foot white oak, 600 feet south from river, at first timber below Saline City, Mo	192.648	217.1
$\frac{45}{1}$ Saline City.	On right bank, about one-half mile above Saline City, Mo., near mouth of second creek, about 300 feet from river bank and same distance from bridge over creek. It is on north side of creek at foot of bluff..........	201.026	218.4
$\frac{45}{2}$	On left bank, 6,579 feet southeast of $\frac{45}{1}$, in north and south fence, on land owned by J. Liggett, and about one-half mile south from his house, which is on corner of road about 500 feet from river........	186.211	....
$\frac{45}{3}$	On left bank, on continuation of line from $\frac{45}{1}$ to $\frac{45}{2}$, 3,396 feet from $\frac{45}{2}$. Is 1,100 feet south of little valley where brook and road enter bottom land, 800 feet north of point where creek comes to bluff, 300 feet south of rock spur 40 feet high, and 30 feet from foot of bluff, in west fence of road running along bluff..........	186.564	....
137 (38)	Horizontal furrow in head of copper bolt leaded into rock at uppermost exposure, one-half mile above Saline City, Mo...	187.785	218.4
138 (37)	On 8-inch sycamore, 150 feet from river, 1½ miles above Saline City, Mo	190.634	219.4
139 (36)	On 2-foot elm, 80 feet from river, on high sand knoll in point of timber opposite foot of island below Glasgow, Mo	200.888	223.2
$\frac{46}{1}$ Glasgow.	On right bank, opposite Glasgow, Mo. It is 1,620 feet west of center of Sec. 9, T. 51, R. 18, and about 20 feet north of center of lane running west from center of Sec. 9, in edge of wood, 1,150 feet west of high bench and B. Meyer's house on bench, and one-quarter mile southwest of H. Mastermann's house on bench..........	197.471	224.4
$\frac{46}{2}$	On left bank, about 10,000 feet below Glasgow, Mo., 175 feet above mouth of first creek below Hurricane Creek, on little bottom just back of fence in recess in bluff. Rocky ledge begins on bank, about 125 feet above the B. M..........	196.776	224.4
140 (35)	On 4.1-foot cotton-wood, 70 feet from river, 1.1 mile below Glasgow Bridge..........	199.148	225.2
$\frac{47}{1}$	On right bank, opposite Glasgow, Mo. It is 1,620 feet west of center of Sec. 9, T. 51, R. 18, and 20 feet north of center of lane running west from center of Sec. 9, in edge of wood, 1,150 feet west of high bench and B. Meyer's house on bench, and one-quarter mile southwest of H. Mastermann's house on bench. It equals $\frac{46}{1}$..........	197.471	224.4
$\frac{47}{2}$	On right bank, opposite Glasgow, Mo. Is in south fence of road in front of house, about one-half mile from river, 65 feet west from 1.2-foot ash tree, 195 feet east of 1.5-foot burr-oak tree in center of road	204.537	225.9
$\frac{47}{3}$ Glasgow Bridge.	On left bank, at Glasgow, Mo., under center of Chicago and Alton Railroad Bridge, near and on river side of first shore pier which supports end of the nearest deck span to the river. It is under the end farthest from the river..........	208.941	226.5
141 (34)	On upper point of cutwater, fourth pier (counting from left shore), of Glasgow Bridge	199.401	226.5
141 (*a*)	Gauge B. M.—On top of ridge, at joint, between columns of pier No. 1 (counting from left bank), of Glasgow Bridge, Mo..........	200.124	226.5
142 (33)	On 3.1-foot elm, 50 feet north from Chicago and Alton track, 240 feet from river, 1½ miles above Glasgow Bridge..........	205.160	229.9
143 (32)	On 3-foot elm, at fence between fields and woods, 300 feet from river, northwest from house of Edwin Whittle	204.987	231.1
....	B. M. of Glasgow construction party, on 2-foot cotton-wood, 50 feet from river, marked 120.704..........	204.280	....
144 (31)	Equals B. M. of construction party; marked 123.291; on 2-foot sycamore	206.952	....
$\frac{48}{1}$ Cambridge.	At Cambridge, Mo., about 500 feet above "Levee," at foot of Main street, on foot of bluff, just above a spring, and about 50 feet west of a fence, and 15 feet higher than the bottom land..........	213.806	234.7.
$\frac{48}{2}$	Opposite Cambridge, Mo., on left bank, and about 2,000 feet from the river, and near one-quarter post between Sec. 3, T. 51, and Sec. 34, T. 52, R. 18, one-quarter mile east of William Conery's house, and 560 feet west of William Weber's house..........	202.265	....
$\frac{48}{3}$	On left bank, opposite Cambridge, Mo. Is near one-quarter post between Sec. 2, T. 51, and Sec. 35, T. 52, R. 18. It is 84 feet northwest from F. Flaspholer's log-house, and one-quarter mile south from B. Hemmelberg's house, 3 feet west of fence, which is 1 rod east of one-quarter section line	....	234.6

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
145 (30)	On 8-inch cotton-wood, 800 feet from river, near △ 498	204.866	235.8
146 (29)	On 2-foot cotton-wood, 100 feet from river, reference tree of △ 494	209.697	237.2
117 (28)	On 3-foot white oak, 120 feet from river, 100 feet east from fence, 2,000 feet below △ 490	212.256	239.2
148 (27) New Frankfort.	On 2.5-foot elm, 400 feet from river, on upper side of ferry road at New Frankfort, Mo	211.459	241.8
149 (26)	On 2.5-foot elm, at foot of cut-off and head of chute behind sand-bar, 2,000 feet from house of —— Baker, in point of timber, 2 miles above New Frankfort, Mo	214.686	242.9
150 (25)	On 2-foot cotton-wood, on Stonewall Point, 200 feet from corner of corn-field, 300 feet from river, and 2,000 feet below mouth of old river-bed	216.995	254.3
151 (24) Grand River.	On 5-foot oak, 500 feet from bluff, at turn in road, 2,000 feet from saw-mill, 1½ miles from river, opposite mouth of Grand River	227.162	256.7
152 (23) De Witt.	On 2.5-foot black walnut, 300 feet west from house of Harve Casebolt, beside road at base of bluff, opposite De Witt, Mo	228.832	262.5
152 (*a*)	Gauge B. M. "No. 1."—On root of 15-inch sycamore, on right bank of run, south of Wabash Depot, 100 feet west of railroad trestle, at De Witt, Mo	233.583	....
152 (*b*)	Gauge B. M. "No. 2."—On root of 20-inch wild locust, 300 feet west of Wabash Depot, 75 feet south of main road leading from the depot to the town, De Witt, Mo	234.695	....
153 (22)	On 2.9-foot white elm, 40 feet west from road, one quarter mile from river, 2 miles below Miami, Mo	230.567	265.0
154 (21) Miami.	On 2.5-foot sugar maple, at roadside and base of bluff, just below first fence below Miami, Mo	235.764	266.5
....	"B. M. 57" of 1878—southwest corner door-sill of main entrance to Smith & Boyer's two-story brick warehouse, facing street running from Levee to town of Miami, Mo	239.504	267.0
....	"B. M. 'C.'" of 1878—a knob chiseled on top of rock in front of Smith & Boyer's two-story brick warehouse, Miama, Mo	232.181	....
155 (20)	On large cotton-wood, about 200 feet from river, at mouth of creek at old upper landing, Miami, Mo	231.805	....
156 (19)	Horizontal furrow in head of copper bolt, set into face of limestone bluff, 1,000 feet above mouth of creek at old upper landing, Miami, Mo	227.002	267.3
157 (S)	On 1.9-foot elm, 550 feet from river, 120 feet southwest of fence between woods above and field below; 550 feet north of one and one-half story frame house; just above first field above Miami, Mo	229.941	268.0
158 (R)	On 2.5-foot hickory, in woods, 90 feet west from north and south fence between woods and corn-field, just above foot of Miller's Island Chute, about 2½ miles above Miami, Mo	234.791	269.5
159 (Q)	On 1.7-foot white elm, 430 feet from river, one-half mile above head of Miller's Island Chute; in heavy woods, 10 feet north of east and west fence	237.036	273.7
160 (P)	On 2.5-foot cotton-wood, 30 feet east of fence between corn above and grove below, 330 feet from river, 300 feet northwest of one and one-half story frame dwelling of Charles Pittman; 1,500 feet below B. M. "O"	240.358	....
161 (O)	On 2-foot black walnut, 150 feet from river, 500 feet northwest of one-story frame house of P. Huff, at lower edge of timber, one-half mile below foot of Prunty Island	241.030	275.8
162 (N)	On 1.5-foot cotton-wood, 100 feet from river, one-half mile above Steele's Landing, opposite foot of Prunty Island	237.548	276.3
163 (M)	On 1.3-foot elm, on edge of high-water bank, 300 feet from chute, about one-half mile below head of Prunty Island, 1¾ miles below Laynesville, Mo	240.887	279.6
164 (L)	On 1.6-foot slippery elm, 400 feet from river, 600 feet north of C. H. Vanstone's saw-mill, three-quarters of a mile below Laynesville, Mo.	241.392	280.7
Laynesville.	"B. M. 55" of 1878—on elm, forked 5 feet from ground, 70 feet from river, 1,000 feet below Laynesville, Mo.; marked 413.043	242.259	281.2
165 (K)	On 2.3-foot elm, on south side of wagon road and edge of old river bank, 300 feet east from end of north and south lane, one-quarter mile from river, one-quarter mile above Laynesville, Mo	239.440	281.6
166 (J)	On 2-foot black walnut, 600 feet from river, on south side of wagon road from Malta Bend Landing to Laynesville, Mo., and about one-half a mile below Malta Bend Landing	242.946	282.9
167 (I)	On 3-foot cotton-wood, 300 feet from river, 240 feet southwest of Fairbank scales at Malta Bend Landing	243.221	283.4
... (18)	On 2-foot oak, on roadside, 100 feet from Grand Pass Lake, 2 miles above Malta Bend, Mo	281.277	285.0
168 (H)	On 2-foot cotton-wood, on high bank behind willow bar, west side of wagon road, 2 miles below Gillam's Landing, Mo	244.484	285.3
169 (G)	On 2-foot cotton-wood, west side of wagon road, 150 feet from river, 630 feet above mouth of creek, 1½ miles below Gillam's Landing, opposite head of large willow bar	244.318	286.0

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
... (17)	On 2-foot elm, on bluff side, 1,500 feet below road from Gillam's Landing to Grand Pass Church, at head of Grand Pass Lake, Mo.	248.387	287.1
170 (F) Gillam's Landing.	On 1.7-foot elm, 500 feet from river, 100 feet north of fence between woods above and fields below, 900 feet below Gillam's Landing, Mo.	243.670	287.2
171 (E)	On 4.5-foot cotton-wood, 120 feet east from north and south fence between fields and woods, 400 feet from river, 500 feet southeast from vacant one-story frame house, 2,100 feet above Gillam's Landing, Mo	243.847	287.7
172 (D)	On 1.7-foot cotton-wood, 130 feet from Cranberry Island Chute, 30 feet below fence between fields above and woods below, 1,050 feet below White's saw-mill, 1 mile above mouth of chute	248.573	290.1
173 (C)	On 1.5-foot elm, 115 feet from high bank of Cranberry Island Chute, and 1,100 feet below its head, 55 feet west of north and south fence between woods on west and small clearing on east	247.579	294.4
174 (B)	On 1.5-foot elm, 350 feet from river, 60 feet above 7-foot fall in ground three-quarters of a mile above head of Cranberry Island Chute, Mo.	254.815	295.2
... (16)	On 1.3-foot oak, at foot of bluff, 1½ miles below Waverly, Mo	254.047	295.9
175 (A)	On 2.7-foot elm, 165 feet from river, at upper edge of timber, 1 mile below Waverly, Mo	252.154	296.4
176 (15) Waverly.	Equals "B. M. 51" of 1878—northwest corner lower window-sill, west window, on river side of "Star Mills," a four-story brick on levee, at Waverly, Mo	263.595	297.4
177 (*a*)	Gauge B. M.—On small, round-topped black oak, 15 inches diameter, at foot of bluff, about 2,500 feet above gauge, about 500 feet above lower edge of first woods above Waverly, Mo	258.500	....
177 (14)	On 2.5-foot twin cottonwood, 110 feet from river, at foot of bluffs, 800 feet below △ 354	255.469	299.8
178 (13)	On 2-foot oak, 75 feet south △ 350, 100 feet above mouth of small creek	259.436	301.3
179 (12)	On 1.5-foot white oak, 1 mile above △ 350	265.259	302.3
180 (11)	On 3-foot black ash, 75 feet from bank, 500 feet from river, 960 feet below James Bray's house	259.052	....
181 (10)	On 4-foot elm, 125 feet from river, near beginning of timber, just below △ 342	264.101	305.5
182 (9)	On 1.7-foot black walnut, 50 feet from river, on bluff, 1,000 feet above △ 340	265.060	306.9
Berlin.	"B. M. 49" of 1878—northwest corner of iron door-sill west door, two-story brick warehouse, at Berlin, Mo	268.872	310.2
$\frac{61}{1}$	At Berlin, Mo., on right bank, at foot of bluff, 582 feet N. 87° W. (mag.) from brick house on bluff, owned by Young E. Gray, 250 feet from river	268.837	310.3
$\frac{61}{2}$	Is on left bank, opposite Berlin, Mo., 9,000 feet from left bank of river, on east and west county road, on south side of road and fence, on land of Dr. Sadderfield, 320 feet, S. 35° 30′ E. from house of N. Edwards, 1,100 feet west of section corner, N. 83° 30′ E	266.730	....
$\frac{61}{3}$	On left bank, 12,480 feet from river, on south side of land belonging to James Long, on north side of east and west road (county), 1,348 feet S. 4° W (mag.) from N. E. corner section 8, T. 51, R. 25, 520 feet S. 62° W. (mag.) from house of S. Diment, 824 feet easterly from where the road turns north	264.530	....
183 (8)	On 2-foot hickory, on bluff side, 50 feet from river, 1,000 feet below △ 330	273.156	310.7
184 (7)	Horizontal furrow in head of copper bolt leaded into rock on side of bluff, about 1,500 feet above △ 326	280.985	312.5
185 (6)	On 5.9-foot cottonwood, 150 feet from river, 250 feet S. E. of △ 320	268.413	314.2
$\frac{62}{1}$ Crooked River.	On right bank, about 5 miles below Lexington, Mo., in north and south lane, close to fence on west side, 1,206 feet from river. It is NE. corner of NW. ¼ of NW. ¼, section 29, T. ——, R. ——, about 1¼ miles below where bluff turns back from the river	262.822	314.2
$\frac{62}{2}$	On left bank, 4,632 feet from river, and N. 2° 30′ E. (mag.) from $\frac{62}{1}$, on north and south road leading from river to Harding, Mo., on west side of road, close to fence, 780 feet N. 9° 30′ W. (mag.) from corners, sections 14, 15, 22, and 23, 500 feet N. 18° W. (mag.) from D. W. Noble's house	273.856	....
186 (5)	On 5-foot oak, on bluff side, near house of W. H. Hays, 100 feet above mouth of creek	290.509	....
187 (4)	On 1.7-foot maple, lower reference tree of △ 314, 100 feet from river	280.849	316.7
188 (3)	On 1.7-foot linn, 70 feet from river, 250 feet above mouth of creek, 500 feet above △ 312	279.819	317.6
189 (2)	On 2.5-foot elm, at base of bluff, just east of mouth of small creek, second reference tree of △ 308, 1 mile below Lexington, Mo	287.348	318.3
189 (*a*)	Gauge B. M.—On 2.5-foot elm, on north side of road, 40 feet from bank, about 100 yards below low-water gauge, and about one-quarter mile below levee at Lexington, Mo	280.541	....
$\frac{63}{1}$ Lexington.	On right bank at Lexington, Mo., on side of bluff, about 50 feet above low-water mark, 175 feet southwest from house owned by J. S. Walters, 2,070 feet down the river from corner Pine and Water streets, 210 feet below (down river) from a hub marking the northeast corner of the laid-out portion of the town of Lexington, Mo. This hub is on section line between sections, 27 and 28 (supposed)	300.343	318.9

Descritpions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
$\frac{63}{2}$	On left bank, 5,840 feet from river, and N. 35° W. (mag.) from $\frac{62}{1}$, on west side of north and south road leading to Lexington, Mo., and close to fence on east side of land belonging to Captain Rankin, 1,480 feet south of where lane leaves road for Captain Rankin's house, and 2,780 feet S. 71° 30′ E. (mag.) from said house	*Feet.* 272.453	*Miles.* ....
$\frac{63}{3}$	On left bank, on continuation of line $\frac{62}{1}$ and $\frac{63}{2}$, 18,400 feet from river on north side of east and west road, on south side of and close to fence, on land belonging to J. F. Barkley, 240 feet N. 89° 30′ W. (mag.) from a supposed one-quarter post, on west side section 11, and 240 feet S. 51° 30′ W. (mag.) of J. F. Barkley's house. House is large two-story frame. B. M. is 700 feet north of Wabash Railroad track	277.393	....
190 (1) Lexington.	Horizontal furrow in head of copper bolt leaded into rock in point of bluff on upper side of Rock Road at Ferry Landing, Lexington, Mo.	306.538	319.3
....	"B. M. 46" of 1878—northwest corner door-sill 2½-story brick machine shops, near depot, and adjoining the Excelsior Stove Works, Lexington, Mo	285.246	....
....	"B. M. 47" of 1878—northwest corner door-sill small door Excelsior Stove Works, 1½-story brick on levee, Lexington, Mo	284.671	....
....	"B. M. 48" of 1878—northwest corner door-sill, main entrance to Lexington City Mills, 3½-story brick	281.100	....
191 (275)	On the top, southeast corner, of cut rock, of which the south face measures 3.9 feet by 2.15 feet, and bears the inscription, "Crump & Hackett, 1858," set near top of masonry and directly over arch on north side of rock bridge across Graham's Branch, three-quarters of a mile above Lexington depot. A cross (+) is cut in the south face of the stone, its center .083 foot below the bench	282.836	320.0
192 (274)	On 1.3-foot hard maple, on foot of bluff, 180 feet south of Missouri Pacific Narrow Gauge Railroad, 100 feet west of lane running south 200 feet northwest of one-story log dwelling of George Heinkel, 2 miles, by railroad, above Lexington, Mo	280.522	321.7
193 (273)	Horizontal furrow in head of copper bolt leaded into cropping ledge of hard rock, northwest exposure, 18 feet south of railway, 75 feet above water-tank, 200 feet from river, three-quarters of a mile above head of "Lexington Bottom," 3 miles above Lexington, Mo	282.107	322.7
194 (272)	Cross (+) cut into top, at northwest corner, of rock abutment at east end of wagon bridge across creek, one-half mile above foot of Wolf Island	283.019	324.8
195 (271)	On 3-foot red elm, 200 feet from river, 60 feet northeast of railroad, 90 feet from foot of bluff, in wagon road, 1¾ miles below Wellington, Mo	280.537	324.7
$\frac{64}{1}$	On right bank, one-half mile below Wellington, Mo., at a point where the bluff leaves the river, opposite head of Wolf Island, on south side of fence, 50 feet south of Missouri Pacific Railroad track, and 250 feet west (up river) from trestle bridge	289.912	326.0
$\frac{64}{2}$	On left bank, on land owned by William Burnett, on south side of fence, on south side of east and west road, in an orchard, 340 feet east of lane running north from road, about one-quarter mile east of graveyard, and one-half mile east of a church. It is 2 miles N. 22° E. (mag.) from $\frac{64}{1}$	274.504	....
196 (270) Wellington.	Horizontal furrow in head of copper bolt leaded into northeast exposure of cropping sand-stone ledge, 60 feet from river, 45 feet from railroad, and 12 feet below its level, 120 feet above ruins of stone warehouse, 1,200 feet below Wellington Flour Mills	285.295	326.4
....	"B. M. 43" of 1878—top of red sand-stone, of which the north face measures 10 by 17 inches, in northeast corner, near top of foundation of Wellington Flour Mills	304.087	....
197 (269)	On 2-foot oak, on side of bluff, west of creek, between creek and wagon road, 130 feet south of narrow-gauge railway, 200 feet from river, one-quarter mile above depot at Wellington, Mo	305.543	326.7
198 (268)	On 1.7-foot red elm, 40 feet from high-water bank, 1,500 feet from edge of shore bar, in clump of timber 2 miles above foot of bottom above Wellington, Mo	280.196	329.4
199 (267)	On 2.5-foot cottonwood, on edge of bank behind large shore bar, one-half mile from river, on line between cottonwood timber on the north and field on the south, 1½ miles below old town of Camden, Mo.	282.384	331.8
200 (265)	On 1.2-foot cottonwood, on south side of small clearing, 550 feet above △ 264, opposite the old town of Camden, Mo	286.645	333.3
201 (266)	Cross (+) cut into top of west abutment, about 4 feet south of track, of 75-foot trestle across creek near Coal Mine No. 5, Camden, Mo. The bridge is numbered 715	288.712	333.3
....	"B. M. 42" of 1878—on extreme northeast corner of top of bridge-seat, west abutment of above bridge	285.269	....
....	"B. M. 41" of 1878—on extreme southeast corner of above bridge-seat.	285.215	....
$\frac{65}{1}$ Camden.	On right bank, opposite Camden, Mo., 5,330 feet from river, on north side of east and west road running from Napoleon to Wellington, Mo., inside of fence inclosing land belonging to F. H. Casteel, 155 feet east of school-house, 1,030 feet west of Union Church, bearing of line $\frac{64}{2}$ to $\frac{65}{1}$, N. 28° 15′ W. (mag.)	279.974	333.3

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
$\frac{65}{2}$	On left bank, at Camden, Mo., 300 feet from river, in southeast corner of yard of R. A. Prichard, facing on the main street, 300 feet northeast from Wabash Railroad Depot	297.743	....
202 (264)	On 1.8-foot elm, on right bank of slough, behind willow tow-head, just above present town of Camden, Mo., 200 feet northwest of one-story frame house, 700 feet above mouth of chute	287.234	333.9
203 (263)	On 2-foot cottonwood, on high-water bank one-quarter mile from river, behind willow and cottonwood island tow-head, 250 feet east of one-story log house of Morris Barnes, 2 miles above mouth of chute, 2½ miles above Camden, Mo	289.324	335.8
204 (262)	On 2.8-foot linn, 220 feet from river, on upper side of shallow dry slough, 2½ miles below Napoleon, Mo.; about one-half mile below upper edge of woods	291.790	337.2
205 (261)	On 3.5-foot honey locust, 270 feet from river, on riverward edge of clump of timber, 1 mile below Napoleon, Mo	292.474	338.7
$\frac{66}{1}$ Napoleon.	At Napoleon, Mo., on right bank, at foot of bluff, 220 feet southwest from railroad depot, 250 feet from river	293.293	339.5
$\frac{66}{2}$	On left bank, opposite Napoleon, Mo., N. 7° E. (mag.) from $\frac{66}{1}$, and 4,186 feet from river, on north side of section 17 (reported to be within 10 feet of one-quarter post) in northwest corner of field belonging to ——— Gordon, and on south side of east and west road	283.626	....
$\frac{66}{3}$	On continuation of line $\frac{66}{1}$ to $\frac{66}{2}$, 2 miles from river, on north side of section 8, 300 feet east of one-quarter mile post, 15 feet east of three-pronged sycamore tree, 6½ feet diameter	284.522	....
206 (260)	Horizontal furrow in head of copper bolt leaded into north face, west side, of stone culvert under railroad, 250 feet above depot at Napoleon, Mo	286.188	339.7
207 (259)	On 3.8-foot cottonwood, 70 feet north of foot of bluff, 450 feet from river, 240 feet southwest of one-story frame house of Theodore Whitson, 1 mile above Napoleon, Mo	289.690	340.7
208 (258)	On 2.8-foot cottonwood, in scattering cottonwood timber and brush, 200 feet south of saw-mill owned by C. S. Hayes, 50 feet southwest of wagon road, one-quarter mile from river, about 3½ miles above Napoleon, Mo	293.375	343.0
209 (257)	On 2.4-foot cottonwood, forked 8 feet from ground, 250 feet south of one-story log and frame house of J. P. Shipley, three-quarters of a mile from river, 4 miles above Napoleon, Mo	296.065	343.7
210 (256)	Cross (+) cut into top of stone foundation at northwest corner of 2½-story brick house owned by Captain Kinney, near △ 226; 5 miles above Napoleon, Mo	303.835	345.0
$\frac{67}{1}$ Mathew's Landing.	On right bank, at "Mathew's Landing," in southwest corner of Mary E. O'Donnell's garden, and 160 feet S. 25° W. (mag.) from her house, a two-story brick house, formerly owned by Mathews	298.523	345.0
$\frac{67}{2}$	On left bank, 3,116 feet from river, magnetic bearing of line $\frac{}{1}$ to $\frac{67}{2}$, N. 38° E. Is close to fence on east side of road, and 198 feet S. 57° 30′ W. (mag.) from H. B. McMullen's house	303.311	....
211 (255)	On 2.9-foot black oak, 160 feet from river, 30 feet from foot of bluff, on timbered flat, one-half mile above B. M. 210	304.186	345.5
212 (254)	On 2.2-foot cottonwood, on fence line between fields on west and woods on east, 280 feet from river, 500 feet above △ 222, 1¼ miles below Sibley, Mo	299.274	346.6
213 (253)	On 1.3-foot elm, on side of bluff, east side wagon road, 250 feet from river, one-half mile below Sibley, Mo	309.067	347.3
214 (252)	Horizontal furrow in head of copper bolt set into northeast exposure of hard rock cropping from foot of bluff at lower end of bar above Sibley, Mo.; 300 feet from river, 300 feet above △ 216, 150 feet north of two-story frame dwelling of Charles and Thomas Spencer.	298.694	347.8
Sibley.	Mr. O. Chanute's H., W. of 1844, at Sibley, Mo., at "Half Brick House," is	310.959	....
215 (251)	On southwest side of 1-foot cottonwood, 340 feet from river, on edge of bench between cottonwood flat and the large willow bar immediately above Sibley, Mo.; vicinity of △ 212	296.105	349.1
$\frac{68}{1}$	On right bank, 2,800 feet north of bridge over small creek running along near foot of bluff, just above Sibley, Mo. B. M. is on west side of north and south county road, close to fence	201.082	348.2
$\frac{68}{2}$ Hull's Point.	On left bank, one-half mile below Hull's Point, in southeast corner of yard around William T. Gryder's house, about one-quarter mile south of county road (east and west). Bearing of line $\frac{68}{2}$ to $\frac{68}{1}$, S. 19° W. (mag.). Distance on line $\frac{68}{2}$ to river, 2,410 feet	296.272	350.7
216 (250)	On 1.6-foot elm, 400 feet from river, at fence between field on east and woods on west, just below foot of long-shore bar, 2 miles above Sibley, Mo.; vicinity of R. B. ⊙ 3, of △ 208	294.966	350.0
217 (249)	On 2.4-foot white elm, on edge of bench, between fields and cottonwood flat, 400 feet from river, 80 feet west of 1-story log house, 600 feet above △ 200, 12,500 feet below mouth of Little Blue River	302.919	353.1
218 (248)	On north side of 2.7-foot sycamore, 240 feet from river, 100 feet from foot of bluff, 160 feet southwest of site of old mill or warehouse, now removed 1¾ miles below mouth of Little Blue River	303.111	353.8

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
219 (247)	On south side of 2-foot shellbark hickory, 450 feet from river, 300 feet west of 1-story frame store building, 3 miles below Missouri City, Mo	308.761	355.9
220 (246)	On west side of 2.6-foot cottonwood, at foot of old river bank, between narrow belt of timber on east and fields on west, 250 feet from river, 60 feet northeast of 1-story log house of Charles R. Cole, 1½ miles below Missouri City, Mo	300.818	357.4
Missouri City.	"B. M. 36" of 1878—top of foundation at southwest corner of 3-story frame grist-mill, near depot, Missouri City, Mo. Bench marked with a cross (+)	304.403	358.9
221 (245)	Equals "B. M. 35" of 1878—cross (+) cut into top of water-table at southeast corner of 2-story brick standing at northwest corner of Water and Doniphan streets, Missouri City, Mo	310.679	....
....	"B. M. 34" of 1878—on top of stone work at southeast corner 2-story brick public-school building on north side of Water street, Missouri City, Mo	312.618	....
222 (244)	On 1.6-foot cottonwood, 20 feet west of lane, 40 feet from edge of high bank, 150 feet from edge of cottonwood flat, 600 feet from river, about one-eighth mile above Missouri City, Mo. (on right bank of river)	310.532	....
223 (243)	On 1.7-foot cottonwood, on east side of lane, 3,100 feet south of river, opposite Missouri City, Mo., 800 or 900 feet from river, westward	306.158	....
$\frac{69}{1}$	On right bank, opposite Missouri City, Mo., 14,035 feet from river. Is on land of John Sullivan, on north side of fence along north side of east and west section road, 1,050 feet east of John Sullivan's house, and 70 feet west of ¼ post on south side of section No. 25 (Sullivan's statement taken for location of post), and 2,472 feet east of northeast corner, section No. 35	303.114	358.9
$\frac{69}{2}$	On right bank, 8,320 feet from river. Is on the farm of John Hiffner, on south side of fence on north side of east and west road, 660 feet N. 78° 45′ E. from "Wapsey" school-house	297.770	....
$\frac{69}{3}$	On left bank at Missouri City, Mo., in southwest corner of H. B. Gillam's front yard, on Main street, 250 feet east of the Methodist Church South	306.509	....
224 (242)	On northwest side of 4.5-foot cottonwood, the center tree of three large cottonwoods standing in fields, one-quarter mile from river, on west side of wagon road running south from Missouri City, Mo., at offset in the road to the west; 600 feet southwest of 1-story log house in grove of walnut trees east of road; about 2 miles south of Missouri City, Mo	306.176	360.9
225 (241)	On 1.8-foot hackberry, in north and south lane, 300 feet southeast of house occupied by Parson Phelps, owned by Wilder Roberts; 360 feet from river, 3½ miles above Missouri City, Mo	312.832	362.1
226 (240)	On 3-foot elm, on line between fields westward and woods eastward, 800 feet from river, one-half mile below foot of Blue Mills Island, 1,600 feet from river by timber line, 4½ miles above Missouri City, Mo.; vicinity R. B. ⊙ 6, △ 174	305.791	363.2
227 (239)	On 2-foot black walnut, in field, 10 feet south of east and west fence, 100 feet southeast of 1-story log house, 500 feet from foot of bluff, opposite head of Blue Mills Island; vicinity of △ 172	312.706	364.5
$\frac{70}{1}$	Is on right bank, at foot of bluff, 1,360 feet below old store-house at Blue Mills Landing, Mo., 100 feet from river	311.656	365.5
$\frac{70}{2}$	On left bank, 2,350 feet from river, N. 14° W. (Mag.) from $\frac{70}{1}$. It is at junction of north and south road with east and west lane, on east side of road, and south side of lane	307.634	....
Blue Mills Landing.	"B. M. 33" of 1878—top of rock ledge at northeast corner of old mill at Blue Mills Landing, Mo. Point marked with a cross (+)	310.021	365.8
228 (238)	Horizontal furrow in head of copper bolt leaded into northern face, 6.5 feet from eastern, and 7.1 feet below upper edge, of projecting ledge of hard rock, on which rests the north end of old mill at Blue Mills Landing, Mo	310.823	....
229 (237)	On 2.9-foot honey locust, 30 feet east of north and south fence, 150 feet east of line between field westward and woods eastward, 100 feet from foot of bluff, three-eighths mile from river, and 1½ miles above Blue Mills Landing, Mo	319.709	366.0
230 (236)	On 1.9-foot sycamore, on southwestern edge of belt of timber bordering river below Liberty Landing, Mo., about 1½ miles from the extremity of the right bank point	311.820	369.7
Liberty Landing.	"B. M. 32" of 1878—on 2-foot cottonwood, forked 12 feet above the ground, on edge of bank, one-fourth mile above Liberty Landing, Mo	312.614	370.2
231 (235)	On 2.5-foot cottonwood, 700 feet east of river, on right bank of slough, 1,600 feet from extremity of point opposite Liberty Landing, Mo	314.854	370.9
232 (234)	On 1.6-foot elm, in cleared land, about 700 feet from edge of woods eastward, 700 feet from woods northward, 1,300 feet from river (westward), 600 feet northeast of house and barn partially wrecked by floods, 3½ miles below Wayne City, Mo	315.406	371.7
233 (233)	On 1.8-foot walnut, on west side of north and south lane, 2,000 feet from river, 450 feet northeast of house of Thomas Smith, 1,000 feet north of foot of bluff, 1½ miles below Wayne City, Mo	321.453	373.7

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation. *Feet.*	Above the mouth. *Miles.*
234 (232)	Horizontal furrow in head of copper bolt set into bowlder of hard rock, lying on south side of wagon road, under fence, 1,200 feet below Wayne City, Mo. The bowlder is about 14 feet long, 8 feet wide, 5 feet thick; the bench is 4 feet from its east end and 2 feet below its top, on its northern face	327.400	375.0
Wayne City.	"B. M. 31" of 1878—on foundation course of masonry at northeast corner of 2-story building, of which the first story is rock, the second frame, at Wayne City or Independence Landing, Mo	324.859	375.2
$\frac{71}{1}$	On right bank, at Wayne City, Mo., about 2,000 feet below the pumping station, Independence Water Works, 170 feet from river, and about 25 feet below ruins of old "Steam-boat Hotel"	319.035	375.2
$\frac{71}{2}$	On left bank, 7,070 feet from river, opposite Wayne City, Mo., and N. 56° 15′ W. (Mag.) from $\frac{71}{1}$. Is close to and on east side of north and south line of fence between farms of —— Clinton and —— Fenie; is on east side of Clinton's farm. B. M. is 5 feet south of a low Elm tree, 2¼ feet diameter	311.003	....
$\frac{71}{3}$ Minnieville.	Is at Minnieville, Mo., on the Wabash Railroad, 500 feet northwest of track. Is in southwest corner of J. W. Spratley's farm, 21 feet west of a point, shown by residents, as SW. cor. Sec. 1, T. 50, R. 32	321.297	....
235 (231)	On 3.5-foot elm, on side of Bluff, 1½ miles above Wayne City, Mo	339.674	376.5
236 (230)	On 1.4-foot sycamore, on side of bluff, 70 feet from river, 1 mile below mouth of Big Blue River, 2½ miles above Wayne City, Mo	329.044	377.5
237 (229)	On 1.5-foot elm, 30 feet from west bank of Rock Creek, 150 feet from river, one-fourth mile below Big Blue River	317.552	378.0
....	"B. M. 28" of 1878—on 1 foot hackberry, reference tree to △ 130	320.588	379.8
238 (228)	On 4.1-foot cottonwood, 260 feet from river, 500 feet above line between woods on the west and fields on the east, 200 feet below △ 130, 1½ miles above mouth of Big Blue River	318.330	379.8
$\frac{72}{1}$ Randolph Bluff.	On right bank, opposite Randolph Bluff, 5,930 feet from river, 8 feet west of corner of junction of east and west and north and south roads. North side of east and west road and west side of north and south road. Lizzie Wright's house is N. 65° E. (Mag.) and 120 feet distant	320.998	382.5
$\frac{72}{2}$	On left bank, at Randolph Bluff, 970 feet up-stream from center line of the Chicago, Milwaukee and Saint Paul Railroad Bridge, and 25 feet toward river from Wabash Railroad track	334.123	....
239 (227)	On 3-foot elm, 480 feet east of 2-story frame dwelling of George Threkel, one-half mile from river, 3 miles below Kansas City, Mo	324.259	383.3
240 (226)	Cross (+) cut into top of stone foundation, on north side, 2.5 feet from northwest corner of 1-story brick fermenting house of Kansas City Distilling Company, 1¾ miles below Kansas City Bridge	328.641	384.6
241 (225)	Cross (+) cut into top of stone foundation, at northeast corner of 4-story brick grist-mill, called "Zenith Mills," 1 mile below Kansas City Bridge	335.091	385.3
242 (224)	Equals "B. M. 26" of 1878—cross cut into top of stone step at southeast corner of 3-story brick on northwest corner of First and Main streets, Kansas City, Mo	352.872	....
243 (223) Kansas City.	Horizontal furrow in head of copper bolt leaded into north face, near east end, of south abutment of Kansas City Bridge	341.694	386.3
244 (222)	Equals "B. M. 24½" of 1878—point of arrow head engraved on south side of first pier north of south abutment of Kansas City Bridge, and marked (erroneously) "High water of 1844"	341.162	....
....	H. W. 1844, K. C. = (December, 1887)	334.200	....
$\frac{73}{1}$ Kansas City.	On right bank, at Kansas City, Mo., 50 feet east of shore pier of Kansas City Railroad bridge, and 10 feet from river bank	332.661	386.3
$\frac{73}{2}$	Is about one-half mile north of Harlem, opposite Kansas City, Mo., 50 feet east of track of Kansas City, Saint Joseph and Council Bluff Railroad, 70 feet east of water-tank, close to, and on east side of right of way fence. Distance from river, 3,460 feet	323.191	....
$\frac{72}{3}$	Is on continuation of line $\frac{72}{1}$ to $\frac{72}{2}$, 2,835 feet from $\frac{72}{2}$, close to and on south side of fence on south side of east and west road, 300 feet N. 76° 45′ E. (Mag.) from William Parker's house, and 480 feet east of railroad track	325.329	....
245 (221)	Equals "B. M. 23" of 1878—cross (+) cut into top of foundation at northwest corner of Union Elevator, Kansas City, Mo	332.629	....
246 (220½) Kaw River.	Cross (+) cut into top of coping, at its northern extremity, of first pier east of west abutment of wagon bridge across Kaw River at its mouth	330.121	388.1
247 (220)	Cross (+) cut into top of stone water-table on north side, near northeast corner, of two-story brick on southwest corner of Third street and Minnesota avenue, Wyandotte, Kans. The rod must be held against the wall, the bench being the top of the bevel	364.760	388.3
248 (219) Wyandotte.	On outer edge, next to corner stone pillar, of iron door-sill on south side next to southwest corner of two-story brick on northeast corner Third street and Minnesota avenue, Wyandotte, Kans	364.159	....
249 (218)	On south side of 3-foot sycamore, 50 feet from edge of high bank, 75 feet east of railroad, 85 feet from foot of bluff, threee-quarters mile from river, 1½ miles above Wyandotte, Kans	340.820	389.8

Description and elevation of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
250 (217)	On 2-foot white elm, in field, about 3,300 feet southeast of △ 96, 400 feet east of small body of timber, 500 feet west of belt of cottonwoods bordering shore bar, 650 feet northwest of one-story frame house, near river bank, 3 miles above Wyandotte, Kans	*Feet.* 329.997	*Miles.* 391.8
251 (216)	On north side of 3.4-foot sycamore, standing by itself in cleared land, 400 feet from river, 1 mile below head of bottom below Quindaro, Kans	332.341	393.5
$\frac{74}{1}$ Quindaro.	On right bank, about one-half mile below Quindaro, Kans., 30 feet north of the Missouri Pacific Railroad track, on line with telegraph poles, 200 feet from river, and about 100 feet below head of Quindaro revetment	333.149	394.4
$\frac{74}{2}$	On left bank, 2,340 feet from river, on west side of north and south road, close to fence, and about 100 feet north of corner of field. Magnetic bearing of line $\frac{74}{1}$ to $\frac{74}{2}$, about N. 16° E	325.988	....
$\frac{74}{3}$	Is 3,100 feet north of $\frac{74}{2}$, on west side of road, and 220 feet N. W. from small frame house occupied by Lew Kirk	336.119	....
252 (215)	Horizontal furrow in head of copper bolt leaded into northern exposure of ledge of rock, 33 feet south of railroad, and 5 feet above its level. 100 feet below creek. 70 feet northeast of ruined stone house at Quindaro, Kans	358.407	394.0
253 (214)	On 2-foot red elm, on bluffside, 250 feet from river, 175 feet south of railroad, 200 feet below creek at foot of bottom above Quindaro, Kans.	356.359	395.7
254 (213)	On 1.7-foot white elm, in field, one-fourth mile north of Missouri Pacific Railroad, 1,000 feet west of belt of cottonwoods bordering river, 1,200 feet southeast of 1½-story frame house in grove, 1 mile above foot of bottom opposite Parkville, Mo	331.577	397.9
$\frac{75}{1}$ Parkville.	On right bank, opposite Parkville, Mo., 4,845 feet from river, 210 feet east of north and south road, and close to northeast corner of Ben Stranger's new log house	328.842	397.9
$\frac{75}{2}$	On right bank, 2,085 feet from river, on east side of road, and south side of lane crossing road, at corner of two hedges. Magnetic bearing $\frac{75}{1}$ to $\frac{75}{2}$, N. 15° W	329.549	....
$\frac{75}{3}$	On left bank at Parkville, Mo., 200 feet from river, on side of bluff, in yard of house occupied by —— Stowe, 300 feet or 400 feet below steam flouring-mill. Magnetic bearing $\frac{75}{3}$ to $\frac{75}{3}$, N. 8° 47′ W.; (angle at $\frac{75}{2}$, 6° 13′)	362.915	....
255 (212)	On west side of 1.7-foot white elm, 150 feet from river, in field, 150 feet east of fence and woods, about one-fourth mile above Parkville, Mo	337.592	398.1
....	"B. M. 20" of 1878—on south side of 3-foot cottonwood, one-fourth mile above Parkville, Mo	333.207	....
256 (211)	On 3 foot elm, 150-feet north of 1-story log house owned by Garret Chestnut, of Platte City, Mo., 1,200 feet from river; one of a group of four elms standing in fields about 1½ miles above Parkville, Mo.	337.365	399.4
257 (210)	On 1.2-foot linn, on foot of bluff, 150 feet from river, 60 feet south of railway, 300 feet above point where river leaves bluff below Pomeroy, Kans	340.245	400.6
258 (209)	Equals "B. M. 19" of 1878—on 1.5-foot linn, 30 feet from river, 100 feet north of railroad, 1,600 feet below creek, about 1¾ miles below Pomeroy, Kans	340.256	401.7
259 (208)	On 1.8-foot white elm, on foot of bluff, 150 feet from river, 40 feet southeast of section-house, 60 feet south of Missouri Pacific Railroad, 1 mile below Pomeroy, Kans	350.230	402.1
260 (207) Pomeroy.	Horizontal furrow in head of copper bolt leaded into northern exposure of rock, on bluff side, 3,500 feet above Pomeroy, Kans. The bench is 125 feet from river, 75 feet south of railroad, and about 21 feet above its level, 960 feet above east end of trestle across Marshall's Creek, and about 150 feet above the beginning of the valley of the creek	360.523	403.8
$\frac{76}{1}$ Connor's Station.	On right bank, at Connor's Station, Missouri Pacific Railroad, in northwest corner of lot, surrounded by picket fence. Lot owned by —— Maxwell, and is nearly east 300 to 400 feet from railroad depot, and 240 feet from and on river side of railroad tracks. A broad lane leads past the lot towards the river	341.213	405.6
$\frac{76}{2}$	On left bank, opposite Connor's Station, Kans., 620 feet from river, close to fence on south side of east and west lane, 420 feet from house of Charles Merrit. It is 1,660 feet west of center sec. 25, T. 50, R. 35	335.962	....
261 (206) Connor's City.	On 2.9-foot red elm, 75 feet west of railway, 40 feet from foot of bluff, 2,000 feet from river, 200 feet from trestle and wagon bridge across creek immediately below Connor's City, Kans	343.336	405.5
262 (205)	On 2.2-foot elm, 300 feet from river, in fields, about one-quarter mile northwest of Connor's City, Kans.; vicinity of R. B. ⊙ 4	339.007	405.7
263 (204)	On 2.4-foot elm, on Diamond Island, 30 feet northeast of one-story frame house, 130 feet from river, 4,500 feet below head of Diamond Island, 600 feet above △ 58	342.026	407.2
264 (203)	On 1.6-foot elm, 250 feet from river, on edge of 6-foot bench, between woods westward and field eastward, 200 feet northwest of house of E. C. Sampson, 200 feet above head of Diamond Island	344.074	408.3

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation. Feet.	Above the mouth. Miles.
265 (202) Ross.	On 1.6-foot black walnut, 150 feet south of house of Samuel Durham, 50 feet west of railroad, one-quarter mile from river, 520 feet northwest of railroad station at Ross, Kans	350.532	409.7
$\frac{77}{1}$	On right bank, 4,300 feet below railroad culvert at Delaware, Kans., on side of bluff, 120 feet from Missouri Pacific Railroad track, 1,610 feet above upper end of trestle bridge	386.097	410.7
$\frac{77}{2}$	On left bank, 3,300 feet from river, on west side of fence, on west side north and south county road, 250 feet southwest from Henry Pellman's house. Magnetic bearing, $\frac{77}{1}$ to $\frac{77}{2}$, N. 67° 45′ E	339.763	....
$\frac{77}{3}$	On left bank, 6,100 feet from river, on continuation of line $\frac{77}{1}$ to $\frac{77}{2}$, on north side of east and west lane. Platte River is 680 feet beyond	340.732	....
266 (201) Delaware.	Cross (+) cut into top, near west edge, of rock projecting from masonry on west end of stone culvert under railway at Delaware, Kans. The bench is 1.6 feet above the top of the keystone of the arch, and directly over its center; about 260 feet south of one-story stone dwelling of Thomas Gibson, on bluff	349.317	411.2
267 (200) Leavenw'h Junction.	On 3.7-foot cottonwood, 40 feet east of Missouri Pacific Railroad, on old river bank, 140 feet northeast of station at Leavenworth Junction, Kans	347.570	412.9
268 (199)	On 2-foot elm, at runlet at foot of bluff, 50 feet west of railway, about 1,200 feet below △ 38, at head of narrow bottom, 2¾ miles below Leavenworth, Kans	350.173	414.1
$\frac{78}{1}$ East Leavenworth.	On right bank opposite East Leavenworth, on bluff, on bank of ravine (lower side), 200 feet from river, and opposite whistle-post at East Leavenworth. Magnetic bearing, $\frac{78}{1}$ to $\frac{78}{2}$, N. 67° 30′ E	304.956	415.0
$\frac{78}{2}$	On left bank, just east of railroad right of way, in edge of field, 700 feet from river, near whistle-post on railroad, B. M. is 2 feet from fence	346.580	....
$\frac{78}{3}$	On line $\frac{78}{1}$ to $\frac{78}{2}$ produced, 6,685 feet from river, close to fence, in field of John Kisker, and 480 feet east from his house	349.364	....
269 (198)	Cross (+) cut into top of stone foundation at southeast corner of seven-story brick glucose factory, at railroad station, South Leavenworth, Kans	353.534	....
270 (197)	Cross (+) cut into top of water-table, under riverward foot of arch forming main entrance to Union Depot, Leavenworth, Kans	355.822	416.8
Leavenworth	"B. M. 5" of 1878—top of water-table, at northeast corner of Union Depot, Leavenworth, Kans	355.829	....
....	"B. M. 3" of 1878—"on Cottonwood, opposite C. 44"	351.109	....
271 (196)	On 4.6-foot cottonwood, at foot of bluff, 90 feet west of railroad, 143 feet from river; 400 feet above C. 44, 1 mile below Leavenworth bridge, Kans	352.019	417.9
$\frac{79}{1}$	On right bank of river, below and about 20 feet from west abutment of railroad bridge at Fort Leavenworth, Kans	376.569	418.9
$\frac{79}{2}$	On left bank, 6,195 feet from $\frac{79}{1}$, on line nearly parallel with railroad. Is about 10 feet west of a wire fence, the boundary line of the Fort Leavenworth Military Reservation. Magnetic bearing of line, $\frac{79}{1}$ to $\frac{79}{2}$, N. 75° E	343.091	....
$\frac{79}{3}$	On line $\frac{79}{1}$ to $\frac{79}{2}$ produced, and 512 feet beyond $\frac{79}{2}$, just east of rail and hedge fence in edge of field	347.559	....
272 (195) Fort Leavenworth.	Equals "B. M. 1" of 1878—Cross (+) cut into top of second course of masonry at southeast corner of three-story stone store-house, Fort Leavenworth, Kans	358.096	418.9
273 (194)	On 1.4-foot white elm, 40 feet from edge of high-water bank, 300 feet from water, 1¾ miles above Fort Leavenworth, Kans	353.477	420.6
274 (193)	On 1.8-foot white elm, 240 feet from river, on 7-feet rise in ground, 1,340 feet below mouth of Kickapooo Island Chute, 1¾ miles below Weston, Mo	358.594	422.9
275 (192) Weston.	On 2.8-foot elm, 40 feet south of 1-story log house, 400 feet from river, in field, 200 feet above cluster of trees one-half mile below Weston, Mo.	353.436	424.1
276 (191)	On 2-foot white elm, 800 feet from river, in northern edge of clump of large trees one-quarter mile west of house of B. Bishop. This house stands about 400 feet southwest of △ 708, and 1 mile above Weston, Mo	358.317	425.6
277 (190)	On 2-foot elm, at foot of bluff, 75 feet from river, 50 feet south of railway, near spring flowing copiously from bluff, at point where bluff and river separate below Kickapoo, Kans	365.350	427.8
278 (189) Kickapoo.	Horizontal furrow in head of copper bolt set into northwest exposure of cut rock, 5 feet south of railway, and 3.5 feet above its level, 912 feet below west end of railway trestle at Kickapoo, Kans	381.366	428.6
279 (188)	On 1.9-foot elm, 586 feet west of Cow Island Chute, on eastern edge of clump of timber, 700 feet below fence and woods near chute, 1 mile above point where river comes to bluff above Kickapoo, Kans.	358.345	429.9
280 (187) Iatan.	On 2.4-foot white elm, on Cow Island, 50 feet east of house of S. Van Winkle, 55 feet from high-water bank, about 1½ miles below Iatan, Mo.	362.880	432.1
281 (186)	On 1.9-foot elm, 345 feet south of Cow Island Chute, one-quarter mile east of main river	361.119	....
282 (185) Oak Mills.	Horizontal furrow in head of copper bolt leaded into exposure of hard rock, 50 feet from river, 17 feet west of railway and 5 feet above its level, 357 feet above whistle post, 600 feet above bottom, one-half mile above village of Oak Mills, Kans., vicinity of △ 690.	369.995	346.1

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
283 (184)	On 1.2-foot black walnut, on left bank, 260 feet above mouth of, and 160 feet above railroad trestle over Little Walnut Creek	370.378	437.3
284 (183)	On 2.1-foot elm, at foot of bluff, 200 feet southwest of railway trestle across creek, three-quarters of a mile below △ 682, 1,200 feet southeast of house of Mrs. John Wallace	369.396	439.5
285 (182)	On 1.6-foot elm, 40 feet south of fence between field on north and woods on south, 70 feet west of railway, 300 feet from river, 1,000 feet south of △ 680, 4½ miles below Atchison, Kans..................	368.488	440.8
286 (181)	On 1.6-foot elm, on foot of bluff, 80 feet from river, 40 feet west of railway, near △ 676, 3½ miles below Atchison, Kans	377.647	442.8
287 (180)	Horizontal furrow in head of copper bolt leaded into hard rock, 35 feet west, and 10 feet above the level of railway, 120 feet from river, 1,870 feet below creek, near which ice-houses stand, about 700 feet below △ 672, 2 miles below Atchison, Kans	385.836	444.0
288 (179)	On 1-foot black walnut, on foot of bluff, 90 feet from river, 40 feet west of railway, 150 feet below mouth of creek, 1½ miles below Atchison, Kans	379.065	444.5
289 (178) Atchison.	Cross (+) cut into top of bevel near base of pilaster on southeast corner of Union Depot, Atchison, Kans..............................	384.503	445.8
....	"B. M. 38" of 1879—on projecting course of three bricks, southeast corner two-story brick general offices Atchison and Nebraska Railroad, on northwest corner of Commercial and First streets, Atchison, Kans	384.628	....
290 (177)	Equals "B. M. 37" of 1879—top of foundation course at northeast corner Atchison and Nebraska Railroad passenger depot, 50 feet south of southwest corner Commercial and First streets, Atchison, Kans	380.859	....
291 (176)	On 2.9-foot hard maple, 90 feet from river, 40 feet west of railway, 2 miles above Atchison, Kans..................................	384.735	447.8
292 (175)	On 2-foot elm, 20 feet west of track, on foot of bluff, one-fourth mile from river, 500 feet above house of William Scott, 3 miles above Atchison, Kans	375.797	448.8
293 (174)	On 1.2-foot ash, on foot of bluff, 175 feet southwest of railroad bridge across creek, 400 feet from river, 1,500 feet south-southwest of △ 656, 1½ miles below Doniphan, Kans..............................	381.973	451.4
294 (173)	Cross (+) cut into top of water-table at northeast corner of two-story brick, second building on west side of Main street, north of Fourth street, Doniphan, Kans., owned by Adam Brenner. (*Doubtful*)....	411.351	452.7
Doniphan.	B. M. "A"—cross (+) cut into top of water-table on south side of Main street, entrance nearest river, about 1 foot north of southeast corner of above building..	411.320	....
295 (172)	On 1.5-foot black walnut, on side of bluff, 60 feet from river, 20 feet west of wagon road, and 10 feet above it, 700 feet below mouth of creek, one-half mile above Doniphan, Kans........................	391.611	453.2
296 (171)	Cross (+) cut into top of stone foundation at southwest corner of 1½ story brick house owned by Nesse heirs, 2 miles above Doniphan, Kans..	385.290	454.7
297 (170)	On 1.3-foot twin elm, on edge of high bank of chute, 680 feet west of main river, 430 feet west of one-story frame house at head of chute above Doniphan; about 1,000 feet northwest of △ 634	385.287	459.0
298 (169)	On 2.3-foot elm, 840 feet from river, 1,400 feet south of one-story frame house, owned by James Butler, about 1,300 feet southwest of △ 630, 2 miles below Geary City, Kans..............................	383.785	460.3
299 (168)	On 1.2-foot white elm, on foot of bluff, 1 mile below Geary City, Kans., 80 feet from river, near △ 626....	392.069	461.0
300 (167) Geary City.	Horizontal furrow in head of copper bolt set into face of first ledge of rock cropping from river front of bluff above Geary City, Kans., about 130 feet from lower end of exposure, 60 feet from river, 25 feet west of wagon road, and 15 feet above its level, 860 feet above saw-mill, 1,500 feet above mouth of creek	406.081	462.4
301 (166)	Cross (+) cut into top of projecting ledge of hard rock just west of old road and 2.5 feet above it, 40 feet from river, 400 feet southeast of dwelling, in vineyard owned by Fred. Moser, vicinity of △ 618, 200 feet above ravine, 1 mile above Geary City, Kans	398.996	463.0
302 (165)	On 2-foot elm, on old river bank, between cottonwood flat and fields, 500 feet from river, 560 feet southeast of one-story log house of E. U. Miller, about 4 miles below Palermo, Kans	387.876	468.1
303 (164)	On 2-foot elm, 300 feet from river, 100 feet from foot of bluff, 213 feet east of 2½-story frame house of Abbott White, 1,000 feet below point where river leaves bluff, 2 miles below Palmero, Kans...............	392.001	470.1
	N. B.—This bench is incorrectly numbered on tree, 163.		
304 (163)	Horizontal furrow in head of copper bolt leaded into west face of bowlder, 50 feet from river, on east side of old wagon road, 1 mile below Palermo, Kans. The bowlder is of hard rock, 40 feet long, 12 feet wide, 6 feet thick; about 1,200 feet above △ 600..............	399.132	471.1
305 (162) Palermo.	On 1.6-foot cottonwood, 80 feet from edge of high bank, behind willow bar, at foot of bluff, 108 feet west of creek, 300 feet above the main street of Palermo, Kans	404.619	472.1

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation. Feet.	Above the mouth. Miles.
306 (161)	On 1.5-foot elm, at fence, 900 feet from river, 900 feet above willow bar, on east side of small clump of timber in fields, one-quarter mile southeast of bluffs, 2,550 feet west of north and south lane leading up to Wathena, Kans., 1½ miles above Palermo, Kans	397.041	473.2
307 (160)	On 2.4-foot elm, 250 feet from river, 175 feet northwest of one-story frame house, in edge of woods below field, 1,800 feet below foot of shore bar, 2 miles above Palermo, Kans., near △ 592	396.958	474.3
308 (159)	Cross (+) cut into top of stone projecting 2 inches from base of wall at southwest corner of 1½-story-stone house owned by Mrs. Amanda Corby, about 3¼ miles below Saint Joseph bridge	402.891	476.3
309 (158)	On 2-foot white elm, 130 feet from high bank behind shore bar, one-fourth mile below group of small houses and body of timber near river, 1 mile below J. D. Hier's house, 2¾ miles below Saint Joseph bridge	401.274	476.8
310 (157)	On 2.3-foot sycamore, 60 feet from edge of high bank, 400 feet west of house of J. D. Hier, 1¾ miles below Saint Joseph Bridge	403.420	477.8
311 (156)	On 1.3-foot cottonwood, on first bench back of willow bar, about one-half mile from outer edge of open bar, 1 mile below St. Joseph Bridge.	396.776	478.6
312 (155) St. Joseph.	Cross (+) cut into top, 1.26 feet south of north edge of coping of east pier of bridge at Saint Joseph, Mo	409.844	479.5
313 (154)	Equals "B. M. 34" of 1879—cross (+) cut into northeast corner of foundation on west side of arched entrance (facing the north) of Henry Krug's packing house on southwest corner of Fourth street and railroad, Saint Joseph, Mo	410.590	....
314 (153)	On 2.8-foot elm, on south side of wagon road, 25 feet northeast of house of Allen Porter, 600 feet west of post-office, in town of Elwood, Doniphan County, Kans	404.961	481.7
315 (152)	On 2.1-foot elm, 15 feet west of 1½-story frame house, 220 feet from river, at point where east and west road comes to river, about 2 miles below Belmont, Kans	403.923	483.5
316 (151)	On 2.5-foot elm, 350 feet from river, on southeast edge of small clump of timber, three-quarters of a mile below Belmont, Kans.	406.379	484.8
317 (150)	Horizontal furrow in head of copper bolt leaded into northeast exposure of bowlder of hard rock, at foot of bluff, 200 feet from river, 90 feet southeast of house of L. A. Jackson, Belmont, Mo. The bench is on the line of a fence, under and 20 feet east of a wagon road which runs over the bowlder	412.001	485.5
318 (149) Belmont.	Cross (+) cut into top of stone projecting from southeast corner, near base of wall, of entrance to Lime Kiln, one-half mile above Belmont, Kans	411.800	486.0
....	B. M. on 2-foot black walnut tree, 200 feet southeast of L. A. Jackson's house, Belmont, Kans	407.963	....
319 (148)	On 1-foot black walnut, 40 feet from river, on foot of bluff, 1,000 feet above Anderson Gladden's two-story frame dwelling, 1½ miles above Belmont, Kans	409.446	487.0
320 (147)	On 1.3-foot honey locust, 240 feet west of house of Charles Newton, 140 feet west of north and south lane, 8½ miles above Belmont, Kans	407.788	489.0
321 (146)	On 1-foot elm, on upper edge of woods, 600 feet from river, three-eighths of a mile southeast of log house near river, on the upper side, and about 1 mile from the extremity of the right bank point above Belmont, Kans	408.464	....
322 (145)	Horizontal furrow in head of copper bolt leaded into exposure of hard rock, 10 feet high, 20 feet long, at foot of bluff, 900 feet above two-story stone house of J. Zaiser, near head of bottom above Belmont, Kans., about 4 miles above Belmont by the line of the bluffs.	415.829	494.3
323 (144)	On 1-3 foot cottonwood, 600 feet from river, one of two trees standing near small log house of Daniel Tindall, 1 mile below Amazonia Cut-off, one-half mile southeast of large 2½-story frame dwelling of Patrick Tindall, about half way from △ 558 to △ 560	411.931	495.2
324 (143) Amazonia.	On 1-foot twin black ash, in clump of ash trees one-half mile south of point at Amazonia Cut-off, on edge of 7-foot bench, about one-fourth mile northeast of house of Mrs. Shumann	417.528	499.3
325 (142)	On 2-foot sycamore, 300 feet from river on upper edge of woods, 700-feet above △ 554 three-quarters of a mile above Amazonia Cut-off	417.045	502.5
326 (141)	On 2-foot elm, 400 feet from river, 2,200 feet below B. M. 327	415.068	....
327 (140)	On 3.3-foot elm, 100 feet from river, 150 feet above lane running west, about 1,400 feet southeast of house of Hanley George, 2¼ miles above Amazonia Cut-off	419.357	....
328 (139)	On 2.5-foot elm, 200 feet from river, in edge of field, one-quarter mile below foot of Rush or Solomon's Island	420.620	505.2
....	"B. M. 28" of 1879—equal bench of construction party, and bears their mark "94.820"; on elm edge of bank, 200 feet east from B. M. (139)	416.393	....
329 (138)	On 1.1-foot elm, 240 feet from Rush or Solomon's Island Chute, on line between corn above and woods below, about one-quarter the distance from the head to the foot of the chute	420.902	509.5
0 (137)	On 1.6-foot elm, 260 feet from river, 1,200 feet south of dwelling of William Gabriel 2¼ miles below Charleston, Kans	419.059	510.3

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
331 (136) Charleston.	Equals "B. M. 26" of 1879, and is also initial bench of construction party, their elevation of it being 100,000 feet; on 4.5-foot elm, 60 feet from river, 300 feet below △ 536, just above Charleston, Kans.	421.863	511.9
332 (135)	On 1.3-foot elm, 70 feet from river, on foot of bluff, three-eighths of a mile above Charleston, Kans., 700 feet below mouth of creek	422.662	512.3
333 (134)	On 3-foot oak, 100 feet from river, on foot of bluff, east side of ravine, 2 miles above Charleston, Kans	434.112	513.9
334 (133)	On 1.5-foot linn, on foot of bluff, 60 feet from river, 900 feet below mouth of Mosquito Creek, one-quarter mile northeast of house of C. W. Hargis, 3 miles above Charleston, Kans	426.191	514.9
335 (132)	On 2.4-foot black walnut, 120 feet from river, on bluff, 300 feet above creek, in first valley above Mosquito Creek, three-eighths of a mile above △ 530, 4 miles above Charleston, Kans	436.115	515.8
336 (131) Lafayette Landing.	On 3-foot elm, 30 feet from river, at foot of bluff, 1,740 feet above Lafayette Landing, 1,000 feet above △ 526	426.349	517.4
337 (130)	On 1.4-foot water oak, 40 feet from river, at foot of bluff, one-half mile below mouth of Wolf Creek, 770 feet below foot of willow bar, 1,300 feet below △ 520, 5 miles below Iowa Point, Kans	430.948	519.2
338 (129)	On 3-foot elm, in woods, 150 feet from river, 3,500 feet below △ 516, 3 miles below Iowa Point, Kans	428.419	520.8
339 (128)	On 2.5-foot black walnut, 30 feet west of railroad, 50 feet from river, at foot of bluff, 1,250 feet below △ 514, 1½ miles below Iowa Point, Kans	430.727	522.5
340 (126) Iowa Point.	Cross (+) cut into top of stone foundation at northwest corner of engine-room of 3½-story brick-grist mill owned by Ball Brothers, one-quarter mile south of Iowa Point, Kans., and about one-half mile from river	471.856	524.1
341 (127)	Cross (+) cut into top of stone foundation at northeast corner of main part of above mill	481.211	....
....	"B. M. 23" of 1879—south end of window-sill of two story brick, on northwest corner of Main and Commercial streets, Iowa Point, Kans	446.618	....
....	"B. M. 24" of 1879—south end of window-sill of the third building north of Main street, on west side of Commercial street, Iowa Point, Kans.; a brick store, forming part of the block of buildings upon which is "B. M. 23"	446.836	....
342 (125)	On 3-foot elm, 50 feet west of railroad track, 140 feet north of fence corner, 600 feet below 1½ story frame house on east side of track, 1¾ miles above Iowa Point, Kans	432.655	525.9
343 (124)	On 2-foot cottonwood, 2¾ miles below White Cloud, Kans., in small clump of cottonwoods, at upper edge of corn-field	433.203	528.1
344 (123)	On 1.3-foot cottonwood, 100 feet from river, 2 miles below White Cloud, Kans	433.874	528.8
	NOTE.—The connection of benches 343 and 344 with the main line was unchecked.		
345 (122)	On 2.5-foot elm, in small corner of woods between railway and corn-field, 70 feet east of track, 50 feet northeast of fence, 1¼ miles below White Cloud, Kans	433.509	529.5
346 (121) White Cloud.	Equals "B. M. 21" of 1879—east corner of door-sill of small door east of main entrance to two-story brick livery stable, 75 feet west of southwest corner Main and Water streets, south side Main street, White Cloud, Kans	457.323	530.8
347 (120)	Equals "B. M. 20" of 1879—southeast corner water-table of Union Hotel, a three-story brick (first story, Main street front, of stone), on northwest corner Main and Water streets, White Cloud, Kans	454.949	....
....	Gauge B. M.—Spike driven into south end of east wood-sill of water tank, 375 feet above White Cloud Depot	441.787	....
348 (119)	On 2.5-foot twin cottonwood, 100 feet east of Atchison and Nebraska Railroad, 2 miles above White Cloud, Kans	438.001	532.8
349 (118)	On 2-foot burr oak, 100 feet east of railroad, 300 feet east of foot of bluff, 1,000 feet from river, one-quarter mile below head of bottom, nearly west of △ 492, 1 mile below mouth of the Great Nemaha River, Nebraska	438.817	535.0
350 (117) Great Nemaha River.	On 1.1-foot twin elm, in ravine, 200 feet south of railway, 600 feet above mouth of Great Nemaha River, Nebraska	445.631	535.9
351 (116)	Cross (+) cut into the upper surface, southern edge, of coping stone of east pier of Atchison and Nebraska Bridge across the Great Nemaha River, 3 miles below Rulo, Nebr	441.489	539.7
352 (115)	On 3.3-foot white elm, 250 feet south of railroad, on line between prairie and woods, one-quarter mile west of bridge across Great Nemaha River, Nebraska	440.973	540.0
353 (114)	On 2.1-foot cottonwood, 100 feet east of railroad, 1,000 feet from river, 1,000 feet from bluff, three-quarter mile below Rulo, Nebr	442.761	541.4
354 (113) Rulo.	Equals "B. M. 18" of 1879—cross (+) cut into top of buttress masonry, at northeast corner of stone engine-room of brick grist-mill, owned by Hosford & Gagnon, Rulo, Nebr	456.110	542.1
355 (112)	Cross (+) cut into top of buttress masonry, at northeast corner of elevator adjoining the above mill	455.721	....

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
356 (111)	On 1-foot black walnut, 60 feet from bank on foot of bluff, 400 feet above mouth of creek, three-quarters of a mile above Rulo, Nebr..	454.397	542.8
357 (110)	On 2.5-foot cottonwood, at foot of bluff, at rivulet, where road up river from Rulo enters bottom, 2 miles above Rulo, Nebr..........	448.634	544.1
358 (109)	On 1.7-foot red elm, at foot of bluff, 100 feet northwest of one-story frame house, 3¼ miles above Rulo, Nebr., by line along foot of bluffs................	454.080	....
359 (108)	Top of stone foundation at southeast corner of one-story brick dwelling of Russell Durfee, on foot of bluff, one-quarter of a mile from river, about 5 miles above Rulo, Nebr	466.814	549.1
360 (107)	On 8-inch twin elm, at foot of bluff, 150 feet from river, 860 feet below head of bottom above Rulo, Nebr	456.027	....
361 (106)	On 2-foot oak, at foot of bluff, 2¼ miles below Arago, Nebr..........	454.754	550.0
362 (105)	On 3-foot twin basswood, 30 feet east of bluff, 800 feet from river, 1 mile below Arago, Nebr..................	456.030	551.3
363 (104) Arago.	Cross (+) cut into upper surface of foundation stone under window on south side, near southwest corner of two-story brick store of Joseph A. Kitt, north side Main street, Arago, Nebr..........	503.006	552.3
....	"B. M. 16" of 1879—top course of masonry at southeast corner of foundation of two-and-one-half-story frame house, north side of Main street, 75 feet west of brick store described above..........	505.416	....
364 (103)	On 2.5-foot elm, 40 feet from river, on side of bluff, 1 mile above Arago, Nebr	463.622	553.3
365 (102)	On 2-foot elm, east side of road, 3 miles above Arago, Nebr	462.131	555.3
366 (101)	On 2-foot cottonwood, on east side of road, 4½ miles above Arago, Nebr., by bluff line	471.464	....
367 (100)	On 3-foot elm, edge of river, foot of bluff, 1,000 feet above mouth of creek, three-quarters of a mile below foot of willow bar, 5¼ miles, by bluff line, below Saint Deroin, Nebr	460.825	558.8
368 (99)	On 2-foot red elm, on west side of road, at foot of bluff, three-quarters of a mile above foot of willow bar, 900 feet south of school-house, about 4 miles below Saint Deroin, Nebr	464.130	559.7
369 (98)	On 1.8-foot black walnut, 280 feet south of house of C. Griffin, in hog lot, 40 feet east of road, 3¼ miles below Saint Deroin, Nebr..........	467.582	562.5
370 (97)	On 2.5-foot twin elm, at foot of bluff, 60 feet east of wagon road, 100 feet below fence corner, about 1¾ miles below Saint Deroin, Nebr	468.342	564.1
371 (96)	On 1.2-foot elm, on east side of road and foot of bluffs, at break in bluff line, three-quarters of a mile below Saint Deroin, Nebr	467.728	565.1
372 (95) Saint Deroin.	On 3.3-foot elm, near east line of Nebraska street, Saint Deroin, 600 feet from river, 500 feet north of A. J. Ritter's store..............	469.623	565.8
373 (94)	On 1.7-foot white elm, at roadside, 50 feet from river, on bluff, 1,400 feet below creek, five-eighths mile above Saint Deroin, Nebr.......	503.142	566.4
374 (93)	On 2.5-foot elm, at foot of bluff, 40 feet north of road, 70 feet west of Meadow Creek, one-half mile from river, 1 mile southeast of Hillsdale, Nemaha County, Nebr	478.110	567.7
375 (92) Hillsdale.	On 1.3-foot maple, a double tree, 70 feet from river, one-quarter mile above Hillsdale, Nebr., at head of bottom	479.128	569.2
376 (91)	On 3-foot elm, in ravine, 120 feet from bottom and 600 feet from river, about 2,300 feet above Saint Deroin Creek, where the latter leaves the bluffs, 1 mile below Aspinwall, Nebr..................	487.654	570.8
377 (90) Aspinwall.	On 1-foot black walnut, 100 feet from river, on left bank of creek at Aspinwall, Nebr..................	476.285	571.8
378 (89)	On 1.9-foot red oak, in ravine, 50 feet from river, five-eighths of a mile below mouth of Little Nemaha River, Nebraska	493.716	572.6
379 (88)	On 9-inch maple, 50 feet southeast of house of D M. Frazier, three-quarters of a mile southwest of Nemaha City, Nebr	477.704	573.4
380 (87) Nemaha City.	Cross (+) cut into top of water-table at northeast corner of Huber House (J. B. Huber), corner of Kansas avenue and ——— street, Nemaha City, Nebr..................	505.580	573.9
381 (86)	On 3.5-foot cottonwood, about 1,000 feet below △ 422, between railroad and bluff, three-quarters of a mile above Nemaha City, Nebr.	482.070	574.6
382 (85)	Cross (+) cut into top of stone foundation at southeast corner of Jonathan Hagadorn's brick dwelling, on foot of bluff, 120 feet west of railroad, three-quarters of a mile from river, 1¼ miles above Nemaha City, Nebr..................	484.708	575.2
383 (84) Brownville.	Equals "B. M. 14" of 1879—on 2.5-foot cottonwood, northwest corner Main street and Levee, on curb-line, 30 feet north of north line of Main street, Brownville, Nebr..................	497.102	579.9
384 (83)	On 10-inch ash, at foot of bluff, 75 feet west of railroad, at point where railroad comes to bluff, three-quarters of a mile above Brownville, Nebr..................	484.507	580.6
385 (82)	On 1.1-foot twin willow, 50 feet south of railroad, one-quarter mile from river, 3¾ miles above Brownville, Nebr.; 75 feet east of line between cornfield extending down from Honey Creek and woods—the field owned by Eli Ralsbeck, the woods by ——— Dodd.......	483.490	583.7
386 (81)	On 1-foot white oak, 100 feet from river, in ravine in bluffs, one-half mile below △ 400, 2 miles below Peru, Nebr..................	504.341	586.4

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation. *Feet.*	Above the mouth. *Miles.*
387 (80)	Horizontal furrow in head of copper bolt leaded into face of sandstone bluff near lower end of exposure, 1¼ miles below Peru Depot; 1,150 feet above △ 400; 850 feet below first creek entering river from bluffs below Peru, Nebr	491.970	587.1
388 (79) Peru.	On 2.1-foot cottonwood, 50 feet north of Col. Thomas Maygor's house, on Nebraska Railroad, three-quarters mile northwest of Peru, Nebr.	491.086	588.8
389 (78)	Spike in sill of west window, north side, of brick school-house, District No. 2, Nemaha County, Nebr.; one-quarter mile north of "Bill" Tyner's house, on Peru and Nebraska City Wagon Road, 1½ miles north of Peru, Nebr	494.638	589.6
390 (77)	On 1.3-foot cottonwood, 75 feet southwest of house occupied by Nathan Kelso, at intersection of line between Otoe and Nemaha counties with Peru and Nebraska City Wagon Road. This road runs due north from a point about one-quarter mile west of Peru, Nebr	495.073	....
391 (76)	On 2-foot hackberry, 75 feet northeast of house of J. H. Ressegnie, one-quarter mile from River, about 4 miles due north of Peru, Nebr.; vicinity of R. B. ⊙ 898	497.395	595.0
392 (75)	On 3-foot twin red elm, 150 feet west of railroad, 300 feet from river, 300 feet above fence-corner, 2¼ miles below Otoe City, Nebr	506.512	597.7
393 (74)	On 2.5-foot cottonwood, between railroad and river, 300 feet above △ 378, 800 feet above railroad section-house, 1 mile below Otoe City, Nebr	503.755	599.2
394 (73) Otoe City.	Equals bench of Nebraska City construction party; on spike in root of 1.5-foot burr oak, at southeast corner of J. D. Carmichael's house, Otoe City, Nebr	530.585	599.9
395 (72)	On 1.5-foot willow, 100 feet west of railroad, 6,800 feet above Otoe City, Nebr., by measurement along railroad	505.038	....
396 (71)	On 1-foot elm, 30 feet west of track, in ravine, 1,000 feet above point where river leaves bluff, 2¼ miles below Nebraska City, Nebr	523.682	606.3
397 (70)	Nail in knot, in pile in railroad embankment, 50 feet below Nebraska City, United States water-gauge	522.020	608.5
398 (69)	Equals "B. M. 11" of 1879; datum of Construction party 100 feet lower top of water-table at southwest corner of office of Registered Distillery No. 2, State of Nebraska, at foot of Main street, Nebraska City, Nebr	531.438	....
399 (68) Nebraska City.	On 8-inch ash, at foot of bluff, about 1¼ miles above foot of Main street, Nebraska City, Nebr	515.686	608.5
400 (67)	On 10 inch elm, at foot of bluff, 200 feet below stone quarry, 2½ miles above Nebraska City, Nebr., by measurement along base of bluff.	518.469	....
401 (66)	Equals Permanent Bench of Construction party; on gas-pipe set in cement at site of △ 354. The bench is on a spur of the bluff, 2¼ miles above head of Nebraska City Island Chute, 1,900 feet above mouth of Walnut Creek	544.509	615.4
402 (65)	On 1.3-foot cottonwood, at foot of bluff, 40 feet from river, behind willow bar, about 300 feet above field, 2¼ miles below Wyoming, Nebr	521.051	615.6
....	B. M. "A;" equals bench of construction party; on 2-foot cottonwood, 60 feet below B M. 402	522.706	....
403 (64) Wyoming.	Equals permanent bench of construction party; on gas-pipe set in cement, near ——— Neligh's house, three-eighths mile below Wyoming Landing, Nebr	542.425	616.9
404 (63)	On 1.3-foot willow, in woods and underbrush, 150 feet back of bench behind willow bar, about one-quarter mile above mouth of Weeping-Water Creek, about 1 mile above Wyoming, Nebr	516.038	619.3
405 (62)	On 2-foot elm, three-eighths mile from river, on edge of bench between prairie and willow bar, near house of James W. Baker, 2½ miles below Jones' Point, Nebr	522.400	621.4
406 (61)	On 2.5-foot cottonwood, 325 feet from river, 150 feet above cornfield, near lower edge of timber, about 1 mile below Jones' Point Ferry, Nebr	523.190	622.7
407 (60) Jones' Point.	On 1.2-foot ash, at foot of bluff, 230 feet from river, 600 feet below house and ferry landing at Jones' Point, Nebr.; just above wagon-road where it enters the bluff	529.726	623.7
408 (59)	On 10-inch black walnut, on side of bluff, 60 feet from river; at foot of narrow bottom, 1½ miles above Jones' Point, Nebr	530.377	625.0
409 (58)	On 10-inch walnut, 90 feet from river, near right bank of Raike's Branch, 500 or 600 feet below △ 326, 3 miles above Jones' Point, Nebr	533.406	626.7
410 (57)	On 2.1-foot elm, 130 feet from river, on right bank of Missouri Creek, 1,100 feet below △ 324	534.872	628.1
411 (56)	On 2-foot elm, 170 feet from river, near right bank of creek, where river returns to bluff, below narrow bottom, 600 feet above △ 324, 3¼ miles below Rock Bluff, Nebr	532.190	....
412 (55)	Horizontal furrow in head of copper bolt leaded into face of rock at Calumet Point, 1½ miles below Rock Bluff, Nebr	539.355	630.9
413 (54) Rock Bluff.	Horizontal furrow in head of copper bolt leaded into face of rock, just beneath △ 316, one-half mile above village of Rock Bluff, Nebr.	536.903	632.8

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
414 (53)	On 3.3-foot cottonwood, 25 feet from water of chute opposite lower point of Tobacco Island, 20 feet below fence, and approximately opposite △ 314	537.104	634.3
415 (52)	Horizontal furrow in head of copper bolt leaded into rock, 60 feet below ravine opposite head of Tobacco Island, 1,400 feet below △ 310	545.919	636.3
416 (51) Plattsmouth.	Northern Point, upper edge, of coping of west pier, Burlington and Missouri Railroad Bridge at Plattsmouth, Nebr	551.954	638.3
417 (50)	Equals "B. M. 9" of 1879—on northeast corner of iron window-sill, ground floor, west side of Main-street entrance to three-story brick, southeast corner Main and Third streets, Plattsmouth, Nebr	564.454	639.2
....	"B. M. 10" of 1879—top of bevel of water-table at southwest corner of three-story brick on northeast corner Main and Sixth streets, Plattsmouth, Nebr	577.251	....
418 (49)	Horizontal furrow in head of copper bolt leaded into point of hard rock, about 200 feet above lime-kiln, 1¼ miles above Plattsmouth, Nebr	551.001	639.2
419 (48) Platte River.	On 1-foot cottonwood, on first rise of ground from bar, 3,600 feet above mouth of Platte River, Nebr	544.670	641.5
420 (47)	On 1.3-foot cottonwood, 1,600 feet east by south of house of Joseph Childs, just east of wagon-road, in vicinity of △ 298	545.183	642.9
421 (46)	On 1-foot cottonwood, 50 feet from river, 1,000 feet below mouth of creek, between △'s 292 and 294	546.091	646.3
422 (45)	On 2-foot elm, 200 feet from bank, 300 feet from rise in bank below △ 290	551.800	647.6
423 (44) Bellevue.	On middle one of three large cottonwoods, just east of railroad, one-fourth mile below Bellevue Station, Nebr	557.048	651.5
424 (43)	On 11-inch black walnut, at base of bluff 50 feet west of Burlington and Missouri River Railroad, where river leaves bluff, three-fourths mile above Bellevue Station, just above △ 278	573.399	653.1
425 (42)	On 1-foot black walnut, reference tree of △ 254, at point at which river touches bluff, 7 miles below Omaha, Nebr	568.348	662.1
426 (41)	On 2.5-foot red elm, on south bank of brook between bluffs, 200 feet west of Burlington and Missouri River Railroad, 4 miles below Omab, Nebr	569.469	663.8
427 (40)	On 8-inch white elm, 120 feet eastward from railroad, 300 feet northward from house of Aug. Muskat, between △'s 242 and 244	568.707	666.0
428 (39) Omaha.	On collar (at joint) of north cylinder, west pier of Union Pacific Railroad bridge, at Omaha, Nebr	568.284	667.8
....	Gauge B. M. Head of spike in 16-inch cedar pile, in midst of riprap 150 feet above upper end of willow mattresses, 30 feet from river about one-half mile above Union Pacific Bridge, Omaha, Nebr	563.644	668.3
429 (38)	Equals "B. M. 6" of 1879—on stone door-step south entrance Omaha Silver Ore Smelting Works—southeast corner of step, marked with a cross (+) cut into stone	565.568	668.6
430 (37)	On 8-inch willow 120 feet from river, at mouth of brook, three-fourths mile above Florence, Nebr., near R. B. ⊙ 528	570.506	672.3
431 (36) Florence.	On 8-inch willow (forking at the ground) 60 feet from river, at mouth of rill, one-fourth mile below △ 216, at park or picnic ground above Florence, Nebr	574.306	678.6
432 (35)	On 1.3-foot willow, leaning southward, west of high-water chute, 600 feet from river, between △'s 214 and 216	574.185	....
433 (34)	On 2.5-foot cottonwood (one of two growing together), 100 feet from high-water bank of river, about 2,000 feet above △ 206, at outlet of Calhoun or Stillwater Lake, Nebr	580.174	686.0
434 (33)	On 5-inch cottonwood, 250 feet from river, opposite foot of long island sand-bar, between △'s 200 and 202	582.718	670.4
435 (32)	On 1-foot cottonwood, half mile from river, 60 feet from high-water bank, in brush and scattering willows and cottonwoods, 300 feet below prairie, below △ 198	583.373	....
436 (31)	On 8-inch cottonwood, 120 feet from high-water bank, on bench descending southward, just below △ 196	588.906	696.4
437 (30)	On 1 foot willow, 75 feet from bank, 2,100 feet below old river bed, about 750 feet below R. B. ⊙ 461	588.736	697.0
438 (29) Blair.	On 1.3-foot willow, 120 feet toward river from Sioux City and Pacific Railroad, about one-half mile above Transfer Landing, at Blair, Nebr	593.755	699.6
....	Gauge B M—on 1.7-foot willow, 50 feet toward railroad from bench 438.	594.047	....
439 (28)	On 7-inch ash, at edge of road, on bench, 700 feet above saw-mill at Sandy Point Ferry, Nebr	603.524	612.3
440 (27)	On 8-inch forked ash, on bench, 200 feet from river, one-half mile above Sandy Point ferry and saw-mill	602.256	612.7
441 (26)	On cottonwood log, on sand-bar, on bank of high-water chute between sand-bar and willow bar, between △'s 166 and 168	600.098	713.6
442 (25)	On 6-inch cottonwood, on sand knoll, 600 feet from river, about 2,000 feet below △ 162	607.620	716.1
443 (24)	On 2.5-foot cottonwood, reference tree of △ 158, at beginning of high prairie below willow flat and lake	611.768	717.8
444 (23)	On 1-foot willow, alone in prairie, 100 feet from bank, 300 feet from river, at recess in bank, one-quarter mile above point of small timber, about 500 feet below R. B. ⊙ 360	607.985	718.9

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
445 (22)	On 1.3-foot cottonwood log imbedded in sand, 600 feet from river, near R. B. ⊙ 351	606.532	721.0
446 (21)	On 1.8-foot cottonwood 200 feet from river, at upper edge of prairie, very near site of △ 150	614.436	723.9
447 (20)	On 1.7-foot forked willow, 120 feet from river, 500 feet below end of willow flat below △ 148, about at R. B. ⊙ 342	615.328	724.7
448 (19)	On cottonwood stump imbedded in sand, 1,000 feet below point of small timber, on riverward side of high-water chute near R. B. ⊙ 333	611.778	726.7
449 (18) Little Sioux River.	On branch of cottonwood log embedded in sand, one-quarter mile from river, one-fourth mile above mouth of Little Sioux River	613.701	728.7
450 (17)	On 4-foot cottonwood, 550 feet from river, at end of prairie and beginning of willow bar, one-quarter mile northwest from house of Charles Blackstone, 3,300 feet from △ 138, toward △ 140	622.209	730.6
451 (16)	On box-alder stump, 60 feet from river, about 2,900 feet above △ 138	624.513	731.8
452 (15)	On 1.7-foot cottonwood, 200 feet from river, 300 feet south from house of George Hall, near beginning of timber, about 1,500 feet below △ 128	626.299	735.6
453 (14)	On 10-inch cottonwood, 130 feet from river, at upper end of willow flat, 50 feet from house of Levi Cornell, 1,150 feet below △ 124	631.491	739.0
454 (13)	On 2-foot cottonwood, at point of heavy timber, between △ 122 and △ 124; 250 feet from river, near R. B. ⊙ 286	631.482	740.0
455 (12)	On 1.5-foot cottonwood, 290 feet from river, 1¼ miles below end of prairie, 1 furlong below site of △ 118	634.952	744.2
456 (11)	On 3-foot cottonwood, 150 feet from river, 100 feet north of Elm Creek, just below Decatur, Nebr	640.865	749.3
....	Gauge B. M.—on 6-inch willow, 120 feet west from Bench 456	638.310	....
457 (10) Decatur.	Equals "B. M. 5" of 1879—on 1.8-foot cottonwood, southernmost of a row on west side of Broadway, 50 feet north of Eighth street, Decatur, Nebr	655.117	749.3
458 (9)	Horizontal furrow in head of copper bolt leaded into face of sandstone, 1,500 feet below bench 459, 600 feet below rock point sheer to water, midway between △'s 106 and 108	634.006	750.6
459 (8)	Horizontal furrow in head of copper bolt leaded into face of sandstone bluff, at upper end of exposure above Decatur, Nebr	641.299	....
460 (7)	On root of 14-inch twin elm, 130 feet north from bench behind willow bar, 900 feet west from river, at head of bar and near △ 100	646.885	751.8
461 (6)	On 8-inch cottonwood, on bench behind willow bar, half way between Maple Landing and head of cut-off above Decatur, Nebr., about 700 feet above △ 98	644.166	756.8
462 (5)	On 1.3-foot elm, 150 feet from river, where bank rises from marshy bottom to a height of 20 feet above low water; about 2,000 feet above △ 92	654.380	759.4
Omaha Mission.	"B. M. 4" of 1879—on 3-foot white elm, 125 feet from river, at Omaha Mission; the most northerly of a group of elms at old saw-mill site	658.878	767.7
463 (4)	Horizontal furrow in head of copper bolt leaded into stratum of amygdaloid in sandstone bluff, 250 feet below △ 76. This is the second exposed rock above Omaha Mission, Nebraska	655.091	768.8
464 (3)	On 1.8-foot elm, 160 feet from river, 300 feet below bench, 4,700 feet above △ 48	671.535	781.3
465 (2)	On 3-foot cottonwood, on left bank of Omadi Creek, Nebraska, 300 feet from its mouth	675.500	791.4
466 (1) Sioux City.	Equals "B. M. 1" of 1879—on 2.5-foot red elm, on east side of Hamilton street, half way between Second and Third streets, Covington, Nebr	686.227	802.8
....	"B. M. 1" of Sioux City construction party—on 3-foot cottonwood, just below Sioux City United States gauge	689.150	....
....	B. M. "A"—center of outside edge of sill of false window of basement, west side, near southwest corner of court-house, Sioux City, Iowa	697.817	....
466 "A" *a*	Gauge B. M.—Under side of marked brick in water-table southeast corner of "Sanborn and Follett's" brick building, southwest corner of Third and Water streets, Sioux City, Iowa	692.724	....
467 (87)	On 2.5-foot elm, 400 feet back from bench 466, about 500 feet from river	685.033	....
468 (86)	On southwest side of 4.5-foot cottonwood, 500 feet from river, 240 feet northeast of 1½-story frame house owned by Levi Evans, 100 feet north of fence between fields above and woods below, 500 feet below K 518, about 5 miles above Sioux City, Iowa	687.518	808.9
469 (84)	On 2-foot cottonwood, 350 feet from river, 600 feet above R. B. ⊙ 581, 150 feet above beginning of field, between 7 and 8 miles above Sioux City, Iowa	691.864	809.8
470 (82)	On southeast side of 2.5-foot elm, 500 feet from river, 70 feet from edge of high bank, between woods and willow bar, 800 feet below K 498	694.850	814.7
471 (81)	On 2.5-foot cottonwood, 276 feet from river, in grove of large cottonwood trees at wood-yard, 1½ miles below foot of willow bar, 400 feet below K 493	697.409	815.8

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
472 (80½)	On 1.7-foot cottonwood, 200 feet from river, at foot of willow bar, about 700 feet above wood-yard. The tree is 140 feet below upper edge of clump of large cottonwoods near K 485, about 12 miles above Sioux City, Iowa	699.044	817.4
	N. B.—This bench was erroneously numbered on the tree "80."		
473 (80)	On 1.7-foot cottonwood, 150 feet from high-water bank, 700 feet from river, near foot of shore bar, 1,200 feet above R. B. ⊙ 552, 1,500 feet above Hedge's wood-yard, 13 or 14 miles above Sioux City, Iowa	701.298	819.3
474 (79)	On 1.7-foot willow, 50 feet from north and south fence, 450 feet from river, 250 feet above R. B. ⊙ 535, about 5¾ miles below mouth of Iowa Creek, Nebraska	702.300	826.6
475 (78)	On north side of 3.5-foot cottonwood, 330 feet from river, on land owned by John Thornton, 200 feet above upper edge of clearing on which is wood-yard owned by Joseph Leach, 5 miles below Iowa Creek, Nebraska	700.385	....
476 (77)	On 2-foot elm, 150 feet from river, at base of bluff, 100 feet below the point where road coming up the river enters bluff, 300 feet below K 441, 2¼ miles below mouth of Iowa Creek, Nebraska	704.262	829.2
477 (76)	On up-river side of 2-foot elm, at foot of bluff, 70 feet from river, 25 feet from edge of high bank, 500 feet above K 437, 200 feet above mouth of small creek, 1¼ miles below Iowa Creek, Nebraska	706.542	830.0
478 (75) Iowa Creek.	Horizontal furrow in head of copper bolt leaded into northern exposure of ledge of hard rock in sand-stone, 1,300 feet below Iowa Creek, Nebraska, 35 feet below R. B. ⊙ 518	701.740	831.2
479 (74)	On 3-foot cottonwood, 300 feet from bank, 200 feet below K 429, directly back from R. B. ⊙ 517, 1,060 feet above point above mouth of Iowa Creek, Nebraska	707.223	531.6
480 (73) Ponca Landing.	On 2-foot elm, 350 feet from river, 300 feet from base of bluff, 650 feet above R. B. ⊙ 500, 750 feet above Ponca Landing, Nebraska	711.167	837.9
481 (72)	On 1.2-foot linn, 150 feet from river, in ravine, 250 feet below K 397, 700 feet below foot of island bar on right bank, three-quarters of a mile above Ponca Landing, Nebraska	721.254	838.8
482 (71)	On up-river side of 2.5-foot cottonwood, 300 feet from river, one-half of a mile below foot of shore bar, opposite K 394, 3 miles above Ponca Landing, Nebraska	714.171	840.5
483 (70)	On 2.3-foot cottonwood, behind shore bar, 150 feet from high water bank, 2,500 feet from river, 150 feet below R. B. ⊙ 487, about 4 miles above Ponca Landing, Nebraska	714.927	842.1
484 (69)	On 2.5-foot twin cottonwood, 275 feet from river bank, 610 feet above R. B. ⊙ 481, about 5 miles below Ionia, Nebr	716.970	844.3
485 (68)	On 2.5-foot cottonwood, 210 feet from river, 300 feet below K 306, about 1½ miles below Ionia, Nebr. The bench is on the river side of the tree	719.893	847.7
486 (67) Ionia.	On 2.5-foot elm, on bluff side, about 1,000 feet below the landing at Ionia, Nebr., 220 feet east from 1½-story frame house of Ira Spencer, 360 feet from river	727.835	849.2
487 (66)	On southwest side of 3-foot elm, 320 feet from river, on west side of creek, near foot of shore bar, 50 feet northwest of wagon bridge where county road crosses creek, 270 feet northwest of 1½-story frame house, 400 feet below K 356, three-quarters of a mile above Ionia, Nebr	725.670	849.9
488 (65)	On 3-foot cottonwood, 500 feet from river, 200 feet from high bank of dry chute, 1,000 feet below ⊙ "F" in chute, directly back of R. B. ⊙ 455	719.920	855.1
489 (64)	On 2.9-foot twin cottonwood, 350 feet from river, 1,000 feet below R. B. ⊙ 445, 500 feet toward river from deserted frame house	727.292	....
490 (63)	On 2-foot white elm, 220 feet from river, 40 feet from bluff, 900 feet below head of bottom, 50 feet below old earth-covered log shelter, 1,150 feet below K 337, and about 3 miles below Vermillion Cut-off	728.050	856.8
491 (62)	On river side of 2.5-foot elm, 80 feet from edge of bank, 200 feet from bluff, 800 feet below K 334, 1½ miles below bench 492	729.986	858.2
....	"B. M. 16" of Vermillion construction party, near Vermillion gauge	732.843	....
492 (61)	On 4-foot cottonwood, on side of bluff, 500 feet below mouth of small stream, 500 feet above foot of shore bar formed on right bank of river by Vermillion Cut-off, one-quarter mile below house owned by ——— Butler	731.804	859.4
493 (60) Vermillion Cut-off.	On up-river side of 1.1-foot box-alder, on edge of high-water bank, near K 322, 300 feet from river, 300 feet above 1½-story frame house opposite Vermillion Cut-off	733.637	861.9
494 (59)	On west side of 3.5-foot elm, 105 feet from river, 130 feet from base of bluff, 100 feet below K 314, one-quarter mile below head of bottom	735.171	863.6
Vermillion.	B. M. "D" equal to "B. M. 12" of construction party—on north side of same tree as bench 494	735.322	....
495 (58)	On 1-foot cottonwood, at base of bluff, 200 feet from river, at point where river comes to bluff, near △ 158, 200 feet below foot of shore bar, back from K 309	738.863	864.5
....	"B. M. 11" of construction party	738.015	....

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
496 (57)	On southeast side of 2-foot cottonwood, 20 feet from edge of high bank, 1,200 feet below head of open shore bar, 600 feet below K 297	740.272	868.7
497 (56)	On river side of 2-foot cottonwood, 240 feet from bank, 200 feet above a sand ridge ranging back at right angles with the river, and rising 20 feet above the bottom, 400 feet below K 291	740.196	870.6
498 (55)	On 2.9-foot elm, 275 feet from river bank, directly back from K 284, 200 feet from Potter's △ 11, 200 feet below foot of shore bar	743.046	872.9
....	B. M. "C"—equals bench of Vermillion construction party: on 1.7-foot linn, 50 feet from river, 1,500 feet below K 283	745.286	874.2
499 (54)	On 1.6-foot slippery-elm, on side of bluff, 100 feet from river, near head of shore bar, immediately back from B. M. "C" above	752.034	....
500 (53) Saint James.	On river side of 2-foot cottonwood, at foot of bluff, on north side of road running down-stream from Saint James, Nebr., 90 feet from river, 100 feet above mouth of small creek, one-quarter mile below Bow Creek	743.606	875.5
....	B. M. "B" equals "B. M. 1" of Vermillion construction party; on 2.5-foot cottonwood, 200 feet above bench 500	744.929	....
501 (52)	On 3.3-foot cottonwood, 250 feet from bank of chute behind Saint Helena Island, and 1,500 feet above its foot, 930 feet above R. B. ⊙ 370	749.963	878.4
502 (51)	On 1.7-foot cottonwood, 150 feet from bank of chute behind Saint Helena Island and one-half mile below its head, 1,000 feet above R. B. ⊙ 365	750.829	880.7
503 (50)	On 10-inch twin elm, 50 feet from river, at foot of bluff, opposite K 273, 1,100 feet below landing at Saint Helena, Nebr	753.482	882.6
504 (49) Saint Helena.	On 3-foot cottonwood, 40 feet west of wagon road, 170 feet from river, 1,200 feet above point where river comes to bluff, above Saint Helena, Nebr	754.723	883.8
505 (48)	On 1.3-foot cottonwood, 300 feet from river, directly back from △ 142, at head of shore bar, above Saint Helena, Nebr	756.886	888.0
506 (47)	On north side of 2.5-foot cottonwood, in cottonwood timber, 200 feet from river, 400 feet below foot of shore bar, 600 feet below K 253	757.578	889.2
507 (46)	On northeast side of 1.7-foot cottonwood, at foot of bluff, where river first comes to right bank bluff below Yankton, Dak., 450 feet from river, near mouth of Dorion Creek. This tree is the eighth large cottonwood between the creek and the bluff, counting from the river up	761.775	891.2
508 (45)	On east side of 1.2-foot cottonwood, 100 feet back from high-water bank, one-half mile from edge of shore bar, about opposite K 248. This tree is 300 feet below upper end of a grove of large cottonwood trees, 3½ miles below Yankton, Dak. Blaze on river side of tree. Mark on tree { U. S. B. M. 45 }	760.109	892.1
—— (44½)	On 1.7-foot cottonwood, southeast side of tree, near, probably less than 200 feet from, bench 508. Mark on tree { U. S. B. M. 46 214.046 }	759.798	....
Yankton.	Gauge B. M., at Yankton, Dak.; on head of nail in middle of window-sill on north (down-river) side of August Kunze's brick dwelling, at brick-yard, one-quarter mile below railroad shops	768.761	896.1
509 (44)	On 1-foot water elm, on side of bluff, 75 feet from river, 350 feet above K 230, one-quarter mile above point where river leaves bluff, about 4½ miles above Yankton, Dak	775.093	900.9
510 (43)	On 2.1-foot cottonwood, 300 feet from river, 400 feet above △ 122	771.932	904.8
511 (41)	On east side of quadruple box-alder, 200 feet from river, at K 216, 150 feet west of creek, on slope of the high bank of the creek bottom	773.767	906.8
512 (40)	On 2-foot elm, on side of bluff, 100 feet from river, at point where river leaves bluff, 450 feet below K 212	781.261	907.7
513 (38)	On southwest side of 2-foot cottonwood, in body of large cottonwood timber, behind and 700 feet below head of willow bar, 400 feet from bench between cottonwoods and willows, 800 feet from river, about opposite B 191	778.357	912.7
514 (37)	On 1.5-foot elm, 20 feet from foot of bluff, in edge of woods, just below swamp, 300 feet from river, 550 feet below K 195, about one-quarter mile below point where river leaves bluff, below Bonhomme Island, Dakota	786.634	913.9
515 (36)	On south side of 3-foot elm, 40 feet from river, at foot of bluff, at mouth of chute behind Bonhomme Island, Dakota, 1,300 feet above K 193	782.980	914.7
516 (35)	On 3.3-foot cottonwood, 500 feet from river, 1,000 feet above △ 104, directly back from R. B. ⊙ 252	783.298	917.0
517 (34)	On 3-foot cottonwood, on Bonhomme Island, 300 feet from river, 200 feet above R. B. ⊙ 248, 3,000 feet below head of Bonhomme Island, Dakota	788.112	918.4
518 (33) Bonhomme.	On southwest side of 2.1 foot cottonwood, 500 feet from river, 700 feet northeast of △ 100, a large solitary tree in prairie, about 1½ miles southeast of Bonhomme, Dak	786.313	920.2

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
519 (32)	On 2.5-foot elm, 100 feet from foot of bluff, 400 feet from river, 2,500 feet above Dodson's Landing, 3,000 feet above △ 96; near point where river leaves bluff, 4 miles above Bonhomme, Dak. N. B.—This bench is erroneously numbered on the tree "31"	806.576	922.5
520 (31)	On 2.5-foot cottonwood, 1,000 feet from river, directly back from △ 82	799.692	929.4
521 (30) Springfield.	On 2-foot cottonwood, reference tree to △ 82, 300 feet from river; one of a group of scattering trees at foot of prairie, one-fourth mile above Springfield, Dak	801.036	....
522 (29)	On 3-foot cottonwood, 130 feet from river, in small bottom, just above mouth of Lost Creek, 2,000 feet below mouth of Bazil Creek, 1,400 feet below K 152	799.070	934.5
523 (28) Running Water.	On 1.5-foot twin cottonwood, 50 feet back from bank between willow flat and prairie, 380 feet from outer edge of willows, 700 feet from water, three-fourths mile below Running Water, Dak. This tree is the second from lower end of group of large cottonwoods opposite and below Running Water, Dak	801.596	936.8
524 (27)	On 1.7-foot cottonwood, in willow flat, 100 feet from edge of prairie, 1,200 feet from outer edge of shore bar, opposite old town of Niobrara, Nebr., and the United States water-gauge at Running Water, Dak	801.786	938.4
525 (26)	On 1.2-foot elm, on bluff side, in ravine, 150 feet above ferry landing, at Running Water, Dak	820.718	....
526 (25)	On 2.1-foot cottonwood, 300 feet from river, 250 feet above R. B. ⊙ 169, 2,800 feet below landing for Niobrara, Nebr.; the uppermost of a group of large cottonwoods, about 1¼ miles below mouth of Niobrara River, Nebraska	809.214	940.5
527 (24) Niobrara River.	On 1.7-foot red elm, on bluff side, 100 feet from river, three-eighths mile above mouth of Niobrara River, Nebraska	818.813	941.7
528 (23)	On east side of 1.1-foot cottonwood, on island, 500 feet from river, at head of open bar, 40 feet west of bench between cottonwoods and bar, just above K 130, 1¼ miles above mouth of Niobrara River, Nebraska	810.556	943.1
529 (22½)	On 1.3-foot water elm, forking 9 feet from ground, lone tree in prairie behind willow bar, 180 feet from edge of high-water bank, 850 feet from edge of bar, opposite K 128. N. B.—This bench is erroneously numbered on the tree "25"	811.440	944.9
530 (22)	On 3-foot elm, 200 feet from bank, 270 feet above K 121, 1,270 feet below mouth of small stream, opposite △ 58	814.885	947.4
531 (21) Chouteau Creek.	On west side of 3.5-foot cottonwood, 460 feet from river, near southern line, and about one-quarter mile below the head of belt of small cottonwoods and willows between river and prairie opposite and above the mouth of Chouteau Creek, 800 feet below K 109	814.391	951.0
532 (20)	On 1-foot cottonwood, on side of bluff, at mouth of small stream, 2,500 feet below △ 44, back from K 100	820.496	953.8
533 (19)	On west side of 2.5-foot cottonwood, in ravine, 120 feet from river, 800 feet below K 96	822.568	955.6
534 (18)	On 10-inch red elm, in ravine, 200 feet from river, at K 91	826.555	956.9
535 (17)	On west side of 3-foot cottonwood, on upper side of ravine and dry-water course, 100 feet from river, at sounding stake P. 2, about 700 feet above △ 36	823.557	960.6
536 (16)	On 1.7-foot cottonwood, at foot of bluff, 210 feet from river, at point where river first comes to bluff below Yankton Agency, Dak	817.870	961.7
537 (15) Yankton Agency.	On 1.3-foot cottonwood (one of a group of three), on edge of high bank behind willow bar, 225 feet from river, 300 feet below K 75, one-half mile below Yankton Agency, Dak	824.890	963.0
538 (14)	On northwest side of 2-foot cottonwood, on edge of bench between cottonwood belt and prairie, 260 feet from high-water bank, one-half mile from outer edge of shore bar, one-quarter mile above Yankton Agency, Dak	829.539	963.4
539 (13)	On west side of 1.5-foot ash, 160 feet from river, 800 feet from foot of bluff, opposite △ 28, between river and small clump of willows	828.333	966.3
540 (12)	On 1.3-foot twin cottonwood, on bluff side, 30 feet from bank in mouth of small ravine, about 1,000 feet below △ 24	834.417	968.9
541 (11)	Horizontal furrow in head of copper bolt leaded into point of granite bowlder which protrudes from bluff on east side of small ravine opening on the river 200 feet below K 52	850.031	970.1
542 (10)	Horizontal furrow in head of copper bolt leaded into northeast exposure of large mass of porous rock lying under the bank 450 feet below △ 14	830.669	972.0
543 (9)	On 1.3-foot cottonwood, at foot of bluff, near lower end of shore bar, where river first comes to bluff, below Fort Randall, Dak., 640 feet above K 41	831.914	973.7
544 (8)	On 8-inch cottonwood, 75 feet from edge of bank, 200 feet from river, 550 feet above head of large shore bar, 920 feet above R. B. ⊙ 31	834.644	974.9
545 (7)	On 5-inch twin cottonwood, one fork of which, its top cut off, forms the bench, 200 feet from river, 25 feet back from high-water bank, opposite △ 8, 3 miles below Fort Randall, Dak	837.662	975.6
546 (6)	On 1.7-foot cottonwood, 80 feet from high-water bank, 150 feet from river, 350 feet below head of shore bar, 125 feet below R. B. ⊙ 24, 2 miles below Fort Randall, Dak	838.020	977.0

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
547 (5)	On south side of 2.1-foot elm, 425 feet from river, 125 feet below shallow dry slough, 500 feet above R. B. ⊙ 20, 1 mile below Fort Randall, Dak	830.489	977.7
548 (4) Fort Randall.	Top of fourth course of masonry above foundation at northwest corner of north wing of stone building used as "Christ Church" and "Echo Lodge No. 2," Fort Randall, Dak. A cross (+) is cut into the north face of the building about 1 inch below the bench	889.303	978.8
....	B. M. "A"—cross (+) cut into top of foundation at southwest corner of south wing of above building	886.450	....
549 (3)	On 1.5-foot water elm, on side of bluff, just east of wagon road leading up from saw-mill at landing to Fort Randall, Dak., about 300 feet from river	845.456	....
....	Gauge B. M.—nail in cottonwood, on bank above gauge at Fort Randall, Dak	842.705	....
550 (2)	On 1.7-foot white elm, forked 2 feet from ground, 120 feet from river, on east side of ravine opening on river, 50 feet above sounding stake P. 1	870.262	980.7
551 (1)	On 6-inch twin white elm, 10 feet from bank, 30 feet from river, on side of bluff, 40 feet above small ravine, 800 feet above △ 2	842.592	981.8
552 (91)	On southwest side 16-inch elm, on Chicot Island, 4,000 feet above its foot, 240 feet from river	845.298	986.1
553 (89)	On 48-inch cottonwood, 100 feet from river, 150 feet above R. B. ⊙ 676	848.810	990.4
554 (88) Wheeler.	On 18-inch burr oak, 100 feet from river, just below dry creek bed, opposite Wheeler, Dak	860.104	995.8
555 (87)	On 30-inch elm, 225 feet from river, at edge of prairie, lower corner of cornfield, foot of shore bar, near R. 461, three-fourths mile above Wheeler, Dak	859.583	996.7
556 (86)	On 12-inch cottonwood, 200 feet from river, 150 feet from foot of bluff, 800 feet above R. B. ⊙ 640	860.653	1,002.3
557 (85)	On 30-inch cottonwood, on bluff side, 800 feet below R. 451	863.992	1,004.2
558 (84)	On 30-inch double elm, at foot of bluff, just below ravine, 200 feet from river, 1,000 feet below foot of Little Cedar Island, Dakota	873.517	1,006.8
559 (83)	On 18-inch cottonwood, 250 feet from river, in small ravine, opposite R. B. ⊙ 604, and foot of Hamilton Island, Dakota	873.415	1,012.0
560 (82)	On 18-inch cottonwood, 300 feet from river, 700 feet below foot of bar, in small ravine, 500 feet above R. B. ⊙ 585	878.738	1,018.0
561 (81)	On 16-inch burr oak, 100 feet from river, on edge of bench, 100 feet from foot of bluff, in scrub timber and brush, one-fourth mile above head of Island No. 3, Dakota	887.295	1,023.8
....	G. B. M. On 12-inch cottonwood, immediately back of the Laroche gauge, about 100 feet from bank	883.614	1,026.0
563 (79)	On 24-inch cottonwood, one of two growing together at foot of bluff, 700 feet above R. B. ⊙ 558, 2 miles below Rosebud Landing, Dakota	887.806	1,027.4
563 (78)	On 24-inch cottonwood, 350 feet from river, on bank of small creek, one-fourth mile below foot of island opposite Rosebud Landing, Dakota	884.300	1,030.8
564 (77) Rosebud Landing.	On 24-inch cottonwood, near edge of bluff bank, 150 feet above warehouse at Rosebud Landing, Daktoa	892.510	1,032.2
565 (76)	On 24-inch elm, 125 feet from river, on south side ravine, three-fourths mile above Rosebud Landing, Dakota	900.677	1,033.0
566 (75)	Horizontal furrow in head of copper bolt set into south face of large rock in bank, on left shore of river, just below the lower Bijou hill about 8 miles above Rosebud Landing, Dakota	891.905	1,035.2
567 (74) Bijou Hills.	On north side 36-inch cottonwood, 360 feet from river, in prairie on west side of dry creek bed, 400 feet above R. 373	891.588	1,036.1
568 (73)	On 24-inch elm, 250 feet from river, 300 feet above R. 370	899.082	1,037.0
569 (71)	On 18-inch cottonwood, 150 feet from river, on bluff side, 800 feet below R. 362	897.282	1,039.2
570 (70)	On 24-inch cottonwood, on bluff side where river comes to bluff, 500 feet above R. 359	900.573	1,040.2
571 (69)	On northwest side 36-inch cottonwood, 175 feet from high water bank, 500 feet from river, three-quarters mile below foot of Sonora Island, Dakota	901.229	1,042.5
572 (68)	On 24-inch cottonwood, on edge of bank, behind willow and sand bar, on south side Sonora Island, Dakota, about 200 feet above its foot	901.396	1,043.2
573 (67) Sonora Island.	On 18-inch elm, on first bench back from river, 90 feet from bank, 50 feet from foot of bluff, 800 feet below R. 343, opposite center of General Brooks' Island, Dakota	909.099	1,044.4
574 (66)	On 12-inch elm, 70 feet from river, 400 feet below R. 333, erroneously marked on tree "65"	911.448	1,048.9
575 (65)	On 30-inch cottonwood, on bluff side, 100 feet from river, 500 feet below R. B. ⊙ 484	905.295	1,049.0
576 (64)	On 12-inch cottonwood, 200 feet from river, on right bank of dry creek bed, opposite R. B. ⊙ 477	906.280	1,051.0
577 (63) White River.	On 24-inch cottonwood, 200 feet from river, 500 feet below mouth of dry creek, 600 feet above △ 68	913.517	1,055.2
578 (62)	On 24-inch elm, on side of bluff, 200 feet from river, 500 feet above R. 302	929.255	1,059.8

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Description.	Elevation.	Above the mouth.
		Feet.	*Miles.*
579 (61)	On 15-inch cottonwood, on bluff side, 150 feet below R. B. ⊙ 437	921.552	1,060.8
580 (60)	On 36-inch cottonwood, 500 feet from river, 600 feet from foot of bluff, directly opposite R. B. ⊙ 433, 600 feet below foot of Ida Rees Island, Dakota	920.323	1.061 7
581 (59) Brulé Agency	On 30-inch elm, 500 feet from river, 400 feet below mouth of American River, 2,500 feet east of Lower Brulé Agency, Dak	920.586	1,064.1
582 (58)	On 14-inch elm, 90 feet from bank, in brush and timber, 1,000 feet above foot of Big Cedar Island, Dak	928.108	1,066.9
583 (57)	On 18-inch cottonwood, in ravine, one of three large trees 125 feet back of face of bluffs, 400 feet below R. 281	924.297	1,067.9
584 (56)	On 24-inch cottonwood, 500 feet from river, opposite Chamberlain, Dak., on Big Cedar Island	924.091	1,068.8
585 (55) Chamberlain	On 24-inch cottonwood, 400 feet from river, opposite Chamberlain, Dak., on Big Cedar Island	924.338	1,068.8
....	G. B. M. On 30-inch elm, 300 feet from river, 700 feet above Chicago, Milwaukee and Saint Paul R. R. freight depot, in Chamberlain, Dak	933.153	....
586 (54)	On 30-inch cottonwood, 425 feet from bank, lone tree in prairie, opposite R. 274, 1 mile above Chamberlain, Dak	928.950	1,070.3
587 (53)	On 18-inch burr oak, 800 feet from river, in prairie, one of a group of scattering trees, 500 feet above △ 50′	928.936	1,073.1
588 (52)	On south side of 24-inch burr oak, 275 feet from river, at foot of bluff, about 1,000 feet below R. 265	930.719	1,073.7
589 (50)	Horizontal furrow in head of copper bolt leaded into soap-stone bluff, 1,000 feet above foot of shore bar, 1,000 feet above △ 52	931.872	1,077.5
590 (49) Fort Hale.	On east side 14-inch oak, 50 feet northwest of Commandant's house, at Fort Hale, Dak	939.016	1,082.3
591 (48)	North end, outer edge door-sill, main entrance, east side, Commandant's house, Fort Hale, Dak	941.518	....
592 (47)	On 36-inch cottonwood, on south bank Zephyr Creek, 100 feet from river	937.370	1,083.4
593 (46) Fort Thompson.	On 12-inch elm, 200 feet from river, on west side of ravine, 400 feet below R. 234	959.238	1,086.2
594 (44)	On 15-inch elm, on left bank Camel Creek, 400 feet from river, 550 feet above △ 42	945.812	1,092.4
595 (43) Fish Creek.	On 36-inch cottonwood, on bank of dry creek, 400 feet back from R. B. ⊙ 304, 500 feet above △ 40	947.065	1,095.0
596 (42)	On 18-inch cottonwood, 250 feet from high-water bank, near R. 195, at foot of shore bar and upper end of timber and brush	950.980	1,098.5
597 (41)	On 36-inch cottonwood, 650 feet from river, opposite sounding-stake H 5, one of a group of four large cottonwoods in prairie	952.873	1,100.4
598 (40)	On 22-inch elm, 60 feet from river, at foot of bluff, at lower end of wooded bottom, 300 feet above R. 185	960.834	1,103.7
599 (39)	On 20-inch cottonwood, 500 feet from river, 200 feet from high-water bank, above R. B. ⊙ 260, 300 feet above foot of bar, opposite △ 34′	961.230	1,107.0
600 (38)	On 18-inch cottonwood, 200 feet from river, in cottonwood flat, behind 20-foot sand ridge, 1,300 feet below △ 312	959.278	1,109.6
601 (37) Cul-de-sac Island.	On 48-inch double cottonwood, 75 feet south of foot of plateau, 270 feet from river, 500 feet below R. B. ⊙ 239	970.723	1,114.0
602 (35)	On 30-inch cottonwood, one of a small grove on bluff slope, 1,600 feet above △ 38, 1,000 feet above R. B. ⊙ 231	973.389	1,116.5
603 (34)	On 14-inch elm, 250 feet from river, on bluff side, 600 feet below R. 154	1,010.613	1,117.3
604 (33)	"O" cut in top of bowlder, in ravine, 100 feet from river, at R. 149	981.467	1,118.9
605 (32) Big Bend.	On 14-inch cedar, on side of bluff, in ravine, about 350 feet below R. 136	982.024	1,122.0
606 (31)	On 20-inch cottonwood, 55 feet from river, on edge of bench, 50 feet from base of bluff at R. 129	976.663	1,123.5
607 (30)	On 60-inch cottonwood, 300 feet from river, 1,500 feet below mouth of Medicine Knoll Creek, Dak	976.712	1,126.9
608 (29)	On 72-inch cottonwood, 1,000 feet from river, 250 feet from high-water bank, 300 feet below R. B. ⊙ 183, 1½ miles above Medicine Knoll Creek, Dak	979.608	1,128.6
609 (26)	On 50-inch double cottonwood, on side of bluff, behind shore bar, 50 feet from bluff bank, one-quarter mile below R. 120	984.549	1,132.0
610 (25)	"O" cut in top of large bowlder embedded in bank at R. 118	976.659	1,132.3
611 (23)	On 15-inch cottonwood, 300 feet from river, on bank of dry creek, near R. B. ⊙ 155	982.420	1,135.7
612 (22)	On 12-inch willow, growing from side of bluff, in ravine, 1,000 feet below △ 24′	983.701	1,138.1
613 (21)	On 40-inch cottonwood, 20 feet from south bank of Cedar Creek, 450 feet from river, about one-half mile above foot of D'Orion Island (No. 1), Dakota	986.116	1,139.8
614 (20) D'Orion Island No. 1.	On southwest side 20-inch cottonwood, 130 feet from river, on lower side dry creek bed, three-quarters mile above foot D'Orion Island (No. 1), Dakota, 175 feet above R. B. ⊙ 135	985,979	1,140.2
615 (19)	On 20-inch double elm, 60 feet from river, on bluff side, 350 feet below R. 90	993,290	1,141.7

Descriptions and elevations of bench-marks on the Missouri River, etc.—Continued.

No.	Descrription.	Elevation.	Above the mouth.
		Feet.	*Miles.*
616 (18)	On 16-inch cottonwood, on north side ravine, just above R. 84, 120 feet from river	991.606	1,143.3
617 (17)	On 48-inch cottonwood, on bank of small stream, 1,500 feet from river, 200 feet from high-water bank, 1,000 feet above △ 19′	991.732	1,145.6
618 (16)	On 14-inch elm, forked 5 feet from ground, on edge of prairie plateau, behind narrow belt of willows and cottonwoods, 300 feet below R. 67, about 9 miles below Rosseau, Dak	999.227	1,149.4
619 (15)	"O" cut into large granite bowlder, embedded in beach at foot of bluff, 125 feet from river, at foot of shore bar, 50 feet above R. B. ⊙ 92	991.257	1,150.8
620 (14)	On 15-inch cottonwood, 300 feet from river, 300 feet below R. B. ⊙ 78, 1,000 feet above △ 16	997.618	1,154.6
621 (13)	"O" cut in top of large flat rock, under bank, one-quarter mile below △ 12′	995.499	1,157.2
622 (12)	On south side of 48-inch triple elm, 350 feet from river, just east of dry runlet, about 1¼ miles below Rosseau, Dak	1,006.432	1,157.9
623 (11) Rosseau.	"O" on bowlder, embedded in beach, one-half mile below Rosseau, Dak	995.484	1,158.6
624 (10)	"O" cut in top of bowlder, embedded in dry runlet, 1¼ miles above Rosseau, Dak., 260 feet from bluff bank	1,000.888	1,160.4
625 (8)	On 72-inch cottonwood, branched into six stems, 250 feet from river, one-quarter mile below foot of Farm Island, Dakota, 100 feet below wood-yard	1,009.992	1,165.9
626 (7)	On 30-inch cottonwood, 170 feet from river, in cottonwood timber, just below foot of reach of bluffs, below Fort Pierre, Dak	1,010.018	....
627 (6)	On 15-inch cottonwood, on bank of small stream, 200 feet from river, opposite △ 6′	1,012.278	1,169.3
628 (5)	On 12-inch cedar, on bluff side, 200 feet from river, 500 feet below △ 4.	1,024.615	1,170.5
629 (4)	On 10-inch cedar, on slope of bluff, 150 feet from river, 300 feet above foot of La Framboise Island, Dak	1,019.825	1,172.0
630 (3)	"O" cut in top of granite bowlder, on side of bluff, 600 feet below S. 23, about 2½ miles below Fort Pierre, Dak	1,015.720	1,172.9
631 (2) Ft. Pierre.	On south side 12-inch cottonwood, 5 feet east of east line of lot on which stands G. P. Waldron's dwelling, and 35 feet north of north line of Main street, Fort Pierre, Dak	1,016.689	1,174.2
632 (1)	On east side of 18-inch cottonwood, 50 feet west of G. P. Waldron's dwelling house, 20 feet north of north line of Main street, and 165 feet east of east line of Deadwood street, Fort Pierre, Dak	1,015.216	....

APPENDIX A 3.

REPORT OF MR. JAS. A. SEDDON, ASSISTANT ENGINEER.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., June 20, 1888.

SIR: I have the honor to make the following report of the physical data department for the fiscal year ending June 30, 1888.

As stated in last annual report but little remained to be done in the regular compilation of the data. This has been finished, consisting of the compilation complete with tabulations and reference maps of twenty-four cross-sections in the vicinity of Plattsmouth, and forty-nine cross-sections, with 22 miles of slope in the vicinity of Brownville. In addition to the regular compilation, eleven monthly cross-sections at Bismarck have been plotted on the regular cross-section sheets.

Borings at Nebraska City previously compiled have been revised, and in part put in shape for publication. Also ten of the 1879 discharge observations on the Mississippi River, at Columbus, Ky., used in last annual report in connection with the Saint Charles sediment data, and in which errors were suspected, have been recomputed and found to have been in error about as there indicated.

The yearly gauge sheets of 1886 for twenty regular gauges have been reduced and compiled with current histories. Also bridge gauge records received from Blair, years 1882 to 1887, and from Rulo, years 1883 to 1887, have been reduced and yearly gauge sheets compiled. The current gauge readings have been plotted as received for a check on the observers, and errors investigated.

In the study of the data the following gauge relations were plotted: Sioux City-Omaha, 1880; Omaha-Plattsmouth, 1880; Plattsmouth-Plattsmouth Bridge, 1886 and 1887; Glasgow-Boonville, 1879 to 1885; Boonville-Jefferson City, 1884 to 1886; Boonville-Cedar City, 1881 and 1882; Jefferson City-Hermann, 1884 and 1885; Hermann-Saint Charles, 1885. But as the general investigation of gauge relations and the variations of discharge with gauge, mentioned in the last annual report, was making it more clear that mean discharge curves could not be relied on to determine the discharge without more light on the question of the shifting of these curves from time to time on the gauge scale, for this reason the special plotting of the Missouri River gauge relations was for the time stopped, and work in the main directed to several comprehensive collections of various classes of the data.

Distances of bench-marks from the mouth were compiled for the revised list of "Bench-marks of the Missouri River, 1888."

All available data in regard to bridges across the Missouri River were compiled, such as elevations of the extreme high waters at the bridge sites, clearance at high water, widths of spans, and actual water widths between spans at high and low water.

A tabulation was made of all dates of ice closing and opening of the river from Sioux City to Saint Louis, with yearly and mean diagrams of same, for office record. These diagrams were made with the view of ultimately showing the mean climatic influences affecting the closing and opening of the river from point to point, though as yet the records do not uniformly cover a sufficient time for this.

With the gauge and slope data collected, a comprehensive study of river profiles is in progress. At locations where gauges have been read the elevation of mean high water has been determined for points in a mean high-water plane; and with this a tabulation of the extreme high waters of 1884, where known, and of 1881 and 1883, has been made. Also a tabulation at each gauge of the height and duration of all the high waters above the mean high-water elevation, with diagrams showing the hydrographs of such crests referred to this as a datum plane. Also at all the gauges the mean normal low water has been determined for points in a mean low-water plane; normal low water being taken as the low water prior to the blocking of the river by ice, during which the low-water profile is very irregular. Between these points at the gauges it is proposed to fill out the profiles of mean high and low water from all the slope data that has been taken on the river, and to present with them profiles of bank elevation and extreme high waters as nearly as possible. The work of filling out these profiles is still in progress.

Very respectfully, your obedient servant,

JAMES A. SEDDON,
Assistant Engineer.

First Lieut. THEO. A. BINGHAM,
Corps of Engineers, Secretary Missouri River Commission.

APPENDIX B.

ANNUAL REPORT OF PRESIDENT MISSOURI RIVER COMMISSION, 1887 '88.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., July 10, 1888.

GENTLEMEN: Work under the construction department of the Commission has consisted in repair, construction and care of plant, and in the construction of revetment work at Saint Joseph and Kansas City, Mo. All construction work was in progress at the date of last annual report and was continued during the remainder of the season as far as funds would allow.

At Saint Joseph the rip-rapping of the revetment in lower Bon Ton Bend was completed by the placing of 557 cubic yards of rock, and some 3,000 cubic yards of rock were placed on weak points in the Elwood revetment. The steamer *Alert* and all the large barges were sent to Kansas City for use at that place. During the present season the whole point below the completed revetment at Bon Ton has cut away, and at the same time a very threatening change of channel has taken place above the Saint Joseph water-works. The effect of these changes has been to throw a strong current along the unprotected bank between Belmont and the head of the Elwood revetment. The protection of this bank should be undertaken as speedily as possible or the whole of the Elwood revetment will be washed out and lost. The nature of these changes is indicated on the map accompanying the report of S. Waters Fox, assistant engineer in charge of the Saint Joseph Division, to which reference is made for details, Appendix B 1.

At Kansas City the unfinished revetment in East Bottoms was completed, its total length being 9,035 feet. Of this 2,900 feet were constructed during the present fiscal year and 635 feet of work of the previous season was completed. The incomplete work, done prior to June 30, 1887, suffered some damage during the high water of last summer which was made good in the fall, and there has been no further trouble. On September 22 work was begun at Little Platte Bend, and 4,500 feet of bank to the lower end of the bend was protected. The only peculiarity of this work lay in the fact that the brush covering of the upper bank was omitted, the stone covering being laid directly on the graded bank. There is a considerable gain in economy by this method and the grading is more easily and effectually done. The work has stood well, but will require extension up stream to complete it.

The dike across the slough at the lower end of the town was a most gratifying success. The accretions have been enormous, and are still going on. It will be advisable to raise the dike so as to bring them up to the level of the main bank more speedily, but I think that the East Bottoms work is secure against being flanked from this direction.

During the flood of June and July, 1887, Pest Island and much of the bar in front of Kansas City were washed away. The sand thus carried off was dropped in the wide river in front of the East Bottoms and almost stopped navigation. When discovered it was too late to do anything even if funds had been available, and we were obliged to submit to the annoyance. One tow-boat was kept below the bar and one above; the barges being taken across both ways by the Melusina. To prevent a recurrence of this trouble, I think it will be necessary to put in silt-catching dikes, both in front of Kansas City and opposite East Bottoms, to remove this bar and prevent its reformation.

This same flood caused additional small breaks in the Kaw Bend revetment, which were repaired in the fall, but further damage occurred this spring. Some of these latter breaks were repaired by the railroad companies whose tracks were endangered, but, as will be seen by Assistant Yonge's report, the lower point has been considerably eroded. I am greatly in hopes that this will obviate the trouble which I think is undoubtedly due to the great engorgement of the river at this point. The recession of the bank will open out the throat of the gorge and allow the water to escape more freely. At any rate nothing can be definitely predicted until a survey with cross-sections can be made at high water, for which funds are not now available.

None of the other work on this reach or at Saint Joseph has shown any signs of weakness.

All of the rock used on this reach was procured by hired labor at the Wayne City Quarry with the exception of a few hundred yards purchased at Quindaro. The brush was mainly procured at points below Kansas City. The rock had to be towed an average distance of 15 miles, and the brush an average distance of 64.4 miles—all up stream. This and the great difficulty of getting reliable labor has much enhanced the cost of the work.

After the completion of field operations a low-water survey of the reach was made. All the plant used was hauled out on the bank at Quindaro, except the tow-boats which were wintered at Bushberg, near Saint Louis.

For details see report of Assistant S. H. Yonge, division engineer, Appendix B 2.

CONSTRUCTION OF PLANT.

The fifteen new barges, alluded to in last year's report, were completed during the summer, but owing to low water in the Ohio, could not be brought out until this spring. They are now at Bushberg.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.,
President Missouri River Commission.

The MISSOURI RIVER COMMISSION.

APPENDIX B. 1.

REPORT OF MR. S. WATERS FOX, ASSISTANT ENGINEER.

SAINT JOSEPH, MO., *June* 30, 1888.

COLONEL: I have the honor to submit the following report of the operations under my charge, during the fiscal year ending June 30, 1888. A map of the river in the vicinity of Saint Joseph, Mo., showing, approximately, the channel alignment and the changes of shore-line during the year, accompanies the report.

The completion of the distribution of rock on the mattress constructed last year in Bon Ton Bend and the distribution of 3,000 cubic yards of rock on the Elwood revetment constituted the only remaining construction works contemplated by the project, for the expenditure of the available balance of the Saint Joseph allotment.

Operations in the quarry were continued until July 23, producing 3,493.42 cubic yards of rock; this, with the balance of 131.45 cubic yards on hand July 1, was placed as follows, viz: On Bon Ton revetment 556.87 cubic yards; on the Elwood revetment 3,068 cubic yards. The former work was completed July 9; the latter July 25. The total quantity of rock now on the 4,158 linear feet of revetment in Bon Ton Bend is 10,174.30 cubic yards, or 2.44 cubic yards per linear foot. The total length of revetment constructed to date in Bon Ton Bend is 14,659 feet.

Immediately after the close of the work in Elwood Bend, the United States steamer *Alert* and fifteen barges (25 by 100 feet) were transferred to the Kansas City Division.

The following pieces were pulled out of the river at this point, viz: Quarter-boat No. 5, and six barges (16 by 64 feet).

A shore-line survey of Bon Ton Bend was made September 14, and a map thereof submitted.

Miscellaneous special duties, assigned to me from time to time, during the year, were executed and reported upon as follows, viz: A low-water inspection of the Saint Charles Bridge crossing was made November 29–December 2. A report, accompanied by a map of the reach and cross-sections of the river was submitted under date of December 19, 1887. A standard cable gauge was established on the bridge at Rulo, Nebr., December 28, and a report thereon submitted December 29, 1887.

The clear heights above high and low water, the clear spans at those stages, and the elevations referred to the Saint Louis City directrix, of the bridges at the following points, were determined February 20–28, 1888, viz: Omaha (the new Union Pacific Railroad bridge), Rulo, Glasgow, Boonvlile, and Saint Charles.

A design with estimate of cost of construction of submerged spurs, adapted for use as a bank protection in Missouri River in this vicinity, was submitted under date of March 17, 1888.

A line of check levels was run between Miami, Mo., and De Witt, Mo., May 23 and 29, and a report thereon dated June 4, 1888, submitted.

Attention is respectfully called to the following changes of shore-line as shown approximately on the accompanying map.

Under the persistent action of the main current of the river the larger portion of Grayback Island has been eroded away, and the light deposits in the old bed of the river exposed. This latter yielding freely has in turn uncovered more and more of the upper main bank of Gladden Bottom. Under the peculiar conditions of flow that then obtained, this bank has been subjected to the severest reef action, and has receded rapidly, threatening the stability of the reach below. Of greater immediate importance, however, is the bank erosion noted in Bon Ton Bend, below the revetment. The shore-line has receded so far that the current is delivered against the right bank at a point below the pocket in the bluff line. This pocket heretofore (although not in the interests of navigation) has been instrumental in diverting the main flow of the river from the unprotected bank above the Elwood revetment, but having become inoperative a larger and increasing percentage of the discharge of the river is passing down the right chute. The island has been greatly diminished in area and the right bank eroded somewhat; the old rock dike at E has been flanked, so that there is a considerable draw between it and the shore; abont 300 feet of the revetment below it has been destroyed.

As the upper shore-line of French Bottom recedes the right bank of Belmont Bend will necessarily be subjected to greater scour, and the early construction of the revetment from E to D, as provided in the approved project, made imperative if serious loss to the Elwood revetment is to be avoided.

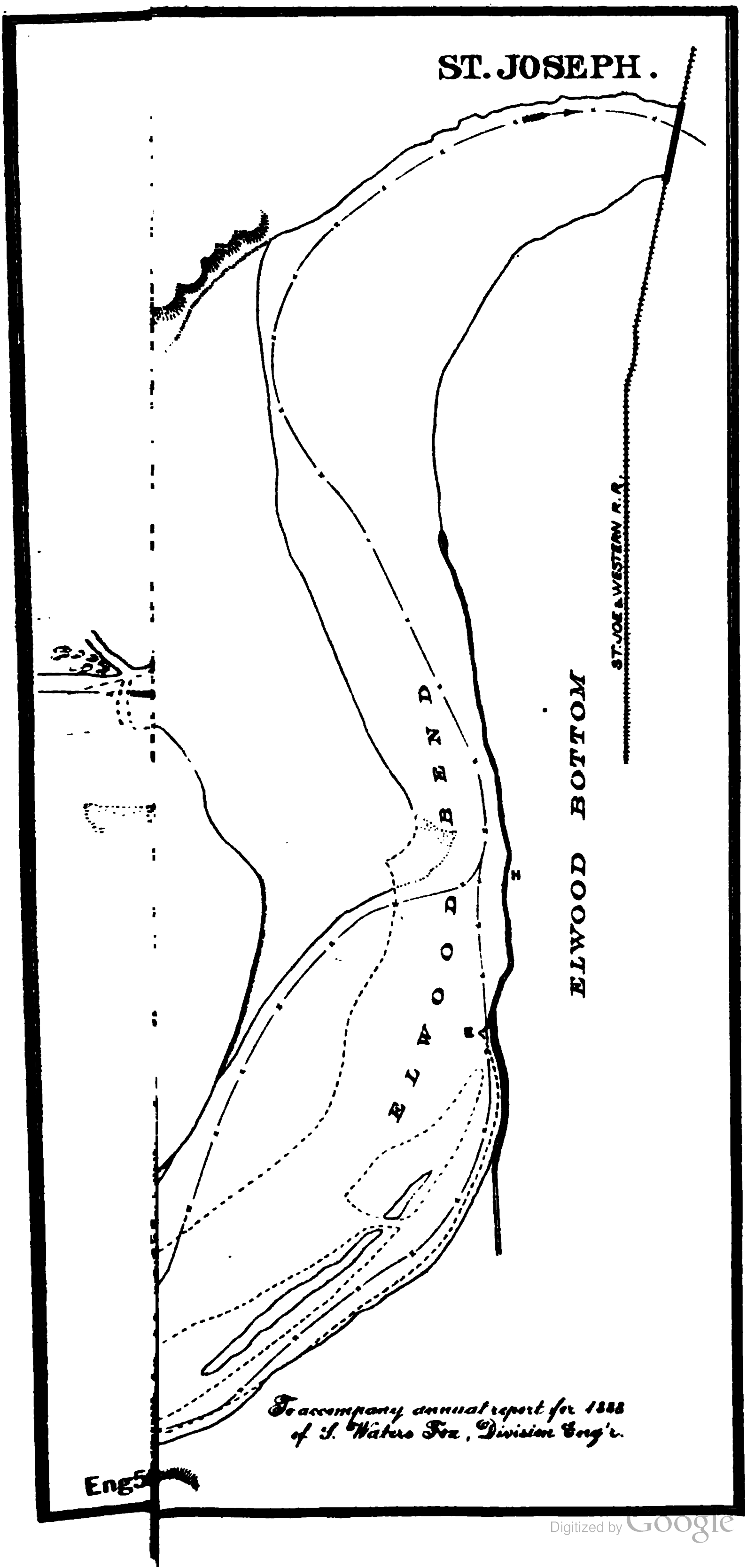
At one stage of these changes a very considerable portion of the river made a short crossing from the bluff above Belmont to the left bank on the lower side of French Bottom, causing the erosion noted there; during the recession of this shore-line the Elwood revetment, from E to H, was subjected to violent reef action; no damage was done to the work except at H, where a small pocket in the shore-line was developed.

The protection of the upper bank of Gladden Bottom is not contemplated in the approved project; and although its desirability seems now apparent, a revetment as suggested in my first project, if located there, would, in the present unstable condition of the river, be liable to loss from flanking. A system of pile training-dikes, located on the right bank at or near the head of Grayback Island, with a view to training the current down the left bank, is suggested as the best solution of the problem. In the absence of an accurate survey definite plans can not be presented, but it is probable that five of these structures, aggregating 1,000 feet in length, and costing about $5,000, would be found necessary and sufficient.

Very respectfully, your obedient servant,

S. WATERS FOX,
Assistant Engineer.

Lieut. Col. CHAS. R. SUTER,
Corps of Engineers, U. S. A.,
President Missouri River Commission, Saint Louis, Mo.



To accompany annual report for 1888 of S. Waters Fox, Division Eng'r.

Eng5

APPENDIX B 2.

REPORT OF MR. SAMUEL H. YONGE, ASSISTANT ENGINEER.

KANSAS CITY, MO., *July* 5, 1888.

COLONEL: I have the honor to submit my report for the fiscal year ending June 30, 1888, for improving Missouri River on Kansas City Division.

The operations conducted on this division consisted chiefly in the following, viz:

(1) Extending the revetment in East Bottoms, below Kansas City, Mo., and completing it as far as practicable.

(2) Constructing revetment in Little Platte Bend.

(3) Repairing the Kaw Bend revetment of 1885.

(4) Repairing the East Bottoms revetment of 1887.

(5) Strengthening the dike at East Bottoms constructed during the spring of 1887.

CONSTRUCTION MATERIALS.

Stone.—The stone used in construction of revetment was procured chiefly by hired labor from the quarry at Wayne City Landing, a small portion being procured by purchase in open market.

The hydraulic stripping, which was fully described in my last report, was continued until August 1, at which date about 7,000 cubic yards of earth, etc., had been removed by this method since June 25, of which quantity about 2,700 cubic yards lodged in the yard in front of the quarry face and had to be removed from there by the use of scrapers and carts, which proved a very difficult task on account of being saturated with water from the hydraulic stripping, and added largely to the cost of stripping.

Two Ingersoll drills, sizes E and FA, respectively, were put in operation July 19, and continued at work until November 12, when the quarrying of stone was discontinued.

The foreman, who had charge of the quarrying on Saint Joseph Division the preceding season, was employed on this work in order to take advantage of his experience, and every means was used to reduce the cost of procuring stone, which, however, was not accomplished to any great extent, the stone being hard and tough, the quantity of current stripping large in proportion to the quantity of stone produced, and the labor being even more transient and unreliable than during the preceding season.

The plan pursued in quarrying consisted in separating from the ledges large masses of stone by blasting, as many as twenty 8-foot holes being sometimes fired simultaneously. These masses, which contained from 2 to 70 cubic yards, were then blockholed and broken into smaller pieces by the use of dynamite, after which such pieces as were not yet sufficiently small were broken by hand sledges. The total quantity of stone procured from Wayne City quarry amounted to 16,768 cubic yards, the average cost of which was $1.1242772 per yard.

Statement giving the cost in detail of stone procured by hired labor.

Application.	Cost per cubic yard.			Remarks.
	Labor.	Subsistence.	Total.	
Quarry privilege			$0.0500000	
Explosives			.0589611	Includes powder, dynamite, caps, fuze, and exploders.
Oil for pump and drills, etc			.0009536	
Coal for stripping			.0073187	Fuel for hydraulic grader.
Coal for drilling			.0108330	
Stripping	$0.1554979	$0.0517289	.2072268	Includes hydraulic stripping.
Quarrying	.3963763	.1318606	.5282369	Includes loosening, drilling, block-holing, and sledging.
Hauling	.1026586	.0341507	.1368093	
Handling	.0929997	.0309381	.1239378	Loading into wagons, unloading, and piling on barges.
Total	.7475325	.2486781	1.1242772	

From the above statement it appears that the expensive items of cost were quarrying and stripping, the reasons for which have already been stated.

The stone procured at Wayne City quarry was towed from 9 to 25 miles to the different works; the average length of tow was 15¾ miles.

As a sufficient quantity of stone could not be furnished from the quarry to supply the needs of the works, there were purchased 1,164 cubic yards of this material, delivered on railroad cars at Kaw Bend at $1.12½ per cubic yard, and 700 cubic yards delivered on barges at Quindaro at 95 cents per cubic yard.

The stone purchased was not of as good quality as that procured from Wayne City Quarry.

The total quantity of stone procured by purchase and hired labor amounted to 18,632 cubic yards, the total quantity used was 19,000 cubic yards, including 121 cubic yards procured by hired labor prior to June 30, at a cost of $1.15¼ per cubic yard, and 247 cubic yards donated by the Kansas City, Saint Joseph and Council Bluffs Railroad Company for the work at Kaw Bend.

The average cost of stone purchased and procured by hired labor for the work was $1.1180147 per cubic yard.

Willow brush.—As several of the brush patches inspected during the spring of 1887 were reported to be of large area, the plan of sending out several small brush parties was departed from and one large party was sent out instead. The procuring of brush was attended by even more than the usual difficulties. The brush on one of the large patches, estimated to contain 5,000 cords, was destroyed by an incendiary fire and the brush of another patch estimated to contain the same quantity was taken by contractors, building dikes for the Wabash, Saint Louis and Pacific Railroad Company. Consequently the large party could not work to such advantage as had been expected and had to be shifted frequently from one brush patch to another. In addition to this difficulty the brush had to be towed, in some instances, a distance of 124 miles up-stream, all of which made the supply of brush irregular, and in some instances the construction parties were compelled, by this, temporarily to suspend construction work and cut such brush as was within their reach in order to be able to proceed with their work.

The average length of tow for all brush was 64.4 miles up-stream. The question of the exhaustion of the supply of willow brush within reasonable towing distance from this point and the attendant difficulties has been discussed in former reports, and it is thought unnecessary to refer to the matter again in this report.

There were procured, in all, 5,956¼ cords at an average cost of $1.75222 per cord, including all expenses except transportation.

CONSTRUCTION WORKS.

Revetment at East Bottoms.—The work of revetting the bank at East Bottoms was resumed August 2.

The revetment of 6,135 linear feet of bank from A to D (see Plate II) before June 30 was completed by covering about 243,000 square feet of upper-bank mat with stone, which had been left uncovered on account of inability to procure a sufficient quantity of this material. There was also constructed 489 linear feet of upper-bank mattress, about 43 feet wide, overlapping the low-water mattress, constructed during the preceding June, at which time it was impossible to give the bank the proper slope for the construction of upper-bank mattress on account of the June flood, the surface of the water being nearly level with the top of the bank.

The revetment was then continued down-stream for a distance of 2,900 feet, the upper 2,550 feet from D to E being of the same type as the adjoining work, constructed the preceding season, while on account of the impossibility of procuring a sufficient quantity of brush for completing the work in progress the lower 350 feet of revetment from E to F was constructed as follows, viz: Small piles were sunk along the shore-line about 10 feet apart, behind which loose brush was laid to form a toe for the bank and to which the transverse cables of a mattress 88 feet wide and extending 10 feet up the bank behind the piles, or to an elevation of about 4 feet above low water, were made fast, being afterwards carried to their anchorage on top of the bank.

On account of the insufficient supply of stone it was impossible in the work done after June 30 to cover the whole face of the bank above low water, and some of the stone which had been previously laid above an elevation of ordinary high water, amounting to about 1,600 cubic yards, had to be removed and used in completing the covering even up to that stage. The area thus covered amounted to 53,345 square feet.

In the case of the lower end of the work, for the same reason, a portion of the bank, amounting to about 16,000 square feet, could not be covered, and about 500 cubic yards of stone will be required to complete this work.

Two construction parties were employed on this revetment, but, for reasons before stated, they were unable to work continuously and to the greatest advantage.

During the construction of mattress it had to be dropped from the boat on two occasions on account of the extension timbers of the mat-boat being broken by the pressure of the strong current.

Mattress-weaving was completed at East Bottoms September 17. On September 22 the whole construction force was transferred to the work at Little Platte Bend, the covering of the upper bank with stone, which was still unfinished, being postponed until after the completion of Little Platte Bend revetment.

This work was resumed October 21 and was completed, as far as practicable, on November 21, when, on account of the approach of winter, construction work had to be suspended.

The following tables, numbered I, II, and III, give the details and cost of the revetment at East Bottoms:

TABLE I.—*East Bottoms revetment.*

[Completing 6,135 linear feet of revetment at East Bottoms, partly constructed prior to June 30, 1887.]

Kind of material or class of work.	Application.	Extent of work.	Quantity of material.	Cost per unit of measure.	Total cost.	Quantity of material per 100 square feet of work.	Cost per 100 square feet of work.
MATERIALS.							
Willow brush	Weaving mattress	20,917 sq. ft	136 cords	$1.75222	$238.30	0.65000 cords	$1.13928
Stone	Sinking mattress below water line	11,000 sq. ft	45 cu. yds	1.1180147	50.31	.40909 cu. yds	.45737
Do	Covering sloped bank above low water	189,150 sq. ft	6,299 cu. yds	1.1180147	7,042.37	3.33016 cu. yds	3.72317
[illegible]-inch wire cable	Construction of mattress	20,917 sq. ft	530 lbs	.04667	24.73	2.53382 lbs	.11823
[illegible]-inch wire cable			693 lbs	.05167	35.80	3.31309 lbs	.17115
Cost of materials					7,391.51		5.60920
LABOR AND SUBSISTENCE.							
Weaving and anchoring mattress	Construction of revetment	20,917 sq. ft			177.79		.34998
	Sinking mattress below water line with stone.	11,000 sq. ft			5.20		.04700
	Placing stone on mattress above low water.	189,150 sq. ft			2,057.96		.08800
	Moving and placing stone formerly placed on bank above high-water line.	53,345 sq. ft			216.31		.40549
Cost of labor and subsistence					2,457.26		2.39047
MISCELLANEOUS.							
Tow-boat service	Transportation of materials, etc				4,260.14		
Despatch-boat service	Moving plant, etc				329.72		
Administration					472.14		
Miscellaneous					418.05		
Cost of transportation, etc					5,480.05		

Amount expended after June 30	$15,328.82
Amount expended prior to June 30	31,991.13
Total cost of 6,135 feet of revetment	47,319.95
Cost per linear foot	7.71311

TABLE II.—*East Bottoms revetment.*

[Construction of 2,550 linear feet of revetment.]

Kind of material or class of work.	Application.	Extent of work.	Quantity of material.	Cost per unit of measure.	Total cost.	Quantity of material per 100 square feet of work.	Cost per 100 square feet of work.	Cost per linear foot.
MATERIALS.								
Willow brush	Weaving mattress	290,905 sq. ft	1,906 cords	$1.75222	$3,339.73	0.65518 cords	$1.14805	$1.30970
Stone	Sinking mattress below water-line.	201,923 sq. ft	851 cu. yds	1.1180147	951.43	0.42300 cu. yds	0.47118	0.37311
Do	Covering bank above low water	89,723 sq. ft	2,746 cu. yds	1.1180147	3,070.07	3.06053 cu. yds	3.42172	1.20395
[illegible]-inch wire cable	Construction of mattress	290,905 sq. ft	12,963 lbs	0.04667	604.94	4.4561 lbs	0.20795	0.23723
[illegible]-inch wire cable			5,339 lbs	0.05167	275.85	1.8354 lbs	0.09483	0.10818
Cost of materials					8,242.02			3.23217
LABOR AND SUBSISTENCE.								
Grading	Sloping bank to angle of 1 on 2½	21,211 cu. yds		0.02845	603.50			0.23666
Weaving and anchoring mattress.	Construction of revetment	290,905 sq. ft			2,462.97		0.84666	0.96587
	Sinking mattress below water-line with stone.	201,923 sq. ft			151.41		0.07526	0.05938
	Covering bank above low-water with stone.	89,723 sq. ft			903.97		1.00751	0.35449
Cost of labor and subsistence.					4,121.85			1.61640
MISCELLANEOUS.								
Tow-boat service	Transportation of materials				5,348.06			2.09727
Dispatch-boat service	Moving plant				413.91			0.16232
Administration					592.71			0.23243
Incidental expenses					524.81			0.20581
Cost of transportation, etc.					6,879.49			2.69784
Total cost					19,243.36			7.54641

TABLE III.—*East Bottoms revetment.*

[Construction of 350 linear feet of revetment.]

Kind of material or class of work.	Application.	Extent of work.	Quantity of material.	Cost per unit of measure.	Total cost.	Quantity of material per 100 square feet of work.	Cost per 100 square feet of work.	Cost per linear foot.
MATERIALS.								
Willow brush	Weaving mattress	31,000 sq. ft	200 cords	$1.75222	$350.44	0.64516 cords	$1.13047	$1.00127
Stone	Sinking mattress below water-line.	26,500 sq. ft	118 cu. yds	1.1180147	131.93	0.44528 cu. yds	0.49783	0.37693
Do	Covering bank above low water	10,530 sq ft	322 cu. yds	1.1180147	360.00	3.05793 cu. yds	3.41888	1.02857
½-inch wire cable	Construction of mattress	31,000 sq. ft	1,777 lbs	0.04667	82.93	5.73226 lbs	0.26752	0.23694
¼-inch wire cable			525 lbs	0.05167	27.13	1.69335 lbs	0.08752	0.07752
Piles	Anchoring mattress at water-line, etc.		43 piles	0.65870	28.32			0.08091
Cost of materials					980.75			2.80214
LABOR AND SUBSISTENCE.								
Weaving and anchoring mattress.	Construction of revetment	31,000 sq. ft			261.78		0.84445	0.74794
	Sinking mattress below water-line with stone.	26,500 sq. ft			21.00		0.07925	0.06000
	Placing stone on sloped bank above low-water line.	10,530 sq. ft			106.07		1.00731	0.30301
Sinking piles	Anchoring mattress at water-line, etc.	43 piles		1.97884	85.09			0.24312
Grading	Sloping bank to angle of 1 on 2½	2,914 cu. yds		0.02845	82.91			0.23689
Cost of labor and subsistence.					556.85			1.59096
MISCELLANEOUS.								
Tow-boat service	Transportation of materials				665.10			1.9003
Dispatch-boat service	Moving plant, etc				51.48			0.1471
Administration					73.71			0.2106
Incidental expenses					65.27			0.1865
Cost of transportation, etc.					855.56			2.4445
Total cost					2,393.16			6.8376

The estimated cost of completing the 9,035 linear feet of revetment at East Bottoms by placing 500 cubic yards of stone on the slope bank above low water is $705.50, which will make the total cost of that work $68,413.26, or an average cost of $7.5720 per linear foot.

Little Platte Bend revetment.—The protection of the bank in Little Platte Bend became imperatively necessary for the reasons stated in my last annual report. As the amount of funds available for this work (after that at East Bottoms would be completed) was small, it was found impossible to construct all the work that will eventually be required for this locality, and to use as expensive a form of protection as the Quindaro type of revetment.

After a consultation with you it was decided to protect the bend from L to C, a distance of 4,500 feet (Plate I) by a partial revetment, similar in construction to the lower 350 feet of the East Bottoms revetment.

Small piles, spaced 10 feet apart, were sunk to a depth of 12 feet by the use of a water jet from one of the pile-sinkers, so as to follow approximately the contour corresponding to the stage 310 on the Kansas City gauge. Loose brush was next laid behind these piles to prevent the toe of the bank from sloughing during the hydraulic grading, and also to even up the shore-line. A woven mattress, about 88 feet wide, was next laid, extending from an elevation of about 312 (Kansas City gauge) into the stream. The transverse mattress cables were first attached to the piles and then carried to the top of the bank to their anchors.

In exceptional cases before, but usually after, the mat was woven, the bank, which in this locality on an average is about 2 feet above the ordinary June rise, was graded to a slope of about 1 on 2¾, at an average cost of $0.01784 per cubic yard of earth removed, including all expenses.

The grader could not work continuously, as from time to time large areas of mattress could not be sunk immediately after it was woven on account of the insufficient supply of stone, and had to be left afloat. That the cost of grading, in spite of this difficulty, is small is to be attributed to its being done after the mat had been woven, which, in connection with the loose brush placed along the water-line, prevented the toe of the bank from sloughing. Hydraulic grader No. 8 was used for this work.

The graded bank between the stages of about 309 and 323 (Kansas City gauge) was covered with stones, both where it was protected by mattress and where not so protected. As the stage of water at the time the work was done was about 311, the area of bank between this stage and 309 had to be covered under water, and therefore this part of the work had to be done at random to some extent. The stone in different places consisted either of quarry spalls or of large stone covered with spalls, or of large stone only. This variation was made to determine, if possible, which of these would afford the most effective protection to that part of the bank which was not covered by mattress.

The sinking of piles began September 6 and was completed October 2, the work being suspended for several days on account of a rise in the river. The greatest number of piles sunk in any one day was 49. After the mattress was woven the piles were sawed off even with the top of it. Three parties were employed in weaving mattress, which work was begun September 17 and completed October 20. The covering of the bank with stone was completed November 5.

Table showing the details and cost of Little Platte Bend revetment.

[Construction of 4,520 linear feet of revetment at Little Platte Bend.]

Kind of material or class of work.	Application.	Extent of work.	Quantity of material.	Cost per unit of measure.	Total cost.	Quantity of material per 100 square feet of work.	Cost per 100 square feet of work.	Cost per linear foot.
MATERIALS.								
Willow brush	Weaving mattress	4,520 linear ft. = 397,835 sq. ft.	2,829 cords	$1.75222	$4,957.03	0.71109 cords	$1.24600	$1.09669
Stone	Sinking mattress below water-line.	340,000 sq. ft.	1,334 cu. yds	1.1180147	1,491.43	0.39235 cu. yds	0.43866	0.32996
Stone	Covering bank above low water	197,872 sq. ft.	5,638 cu. yds.	1.1180147	6,303.37	2.84932 cu. yds	3.185678	1.39455
Piles	Anchoring mattress at water-line.		446 piles	0.21749	97.00			0.02146
¾-inch wire cable	Construction of mattress	397,835 sq. ft.	19,743 lbs	0.04667	921.34	4.96261 lbs	0.23159	0.20384
½-inch wire cable			7,702 lbs	0.05167	397.34	1.93598 lbs	0.10003	0.08804
Cost of materials					14,168.01			3.13451
LABOR AND SUBSISTENCE.								
Weaving and anchoring mattress.	Construction of revetment	397,835 sq. ft.			3,377.51		0.84897	0.74724
	Sinking mattress below water-line with stone.	340,000 sq. ft.			247.25		0.07272	0.05470
	Covering bank above water-line with stone.	153,162 sq. ft.			1,319.35		0.86148	0.29189
	Covering portion of bank between water-line and low water with stone.	44,710 sq. ft.			209.00		0.46746	0.04624
Sinking piles	Anchoring mattress at water line.	446 piles		0.99269	442.74			0.09795
Grading	Sloping bank to 1 on 2¾	24,197 cu. yds.		0.01784	431.70			0.09551
Cost of labor and subsistence.					6,027.55			1.33353
MISCELLANEOUS.								
Tow-boat service	Transportation of materials, etc.				8,735.69			1.93267
Dispatch-boat service	Moving plant, etc				676.11			0.14958
Incidental expenses					968.16			0.21419
Administration					857.25			0.18966
Cost of transportation, etc.					11,237.21			2.48610
Total cost					31,432.77			6.95414

Repairs to Kaw Bend Revetment.—During the spring rise in March, 1887, about 350 linear feet of bank mattress in Upper Kaw Bend, from T to S (see Plate IV), which had been constructed in September, 1885, was undermined. The cause of this damage was supposed at the time to be due to water, which had accumulated on the low ground back from the bank seeping through the bank as the stage of water in the river decreased.

This damage was repaired the following April.

During the June rise of 1887 the revetment was again undermined in places between R and W. Although the action of seep-water has no doubt had some effect, as supposed, the principal cause of the trouble appears to be as follows: It will be seen from Plate IV that the thread of the current impinges at T, where the water-way has decreased in width from about 1,000 feet in October, 1885, to 385 feet in December, 1887, the stage of water, viz, 309, on the K. C. gauge being the same for both dates.

During the higher-water stages of the river the point of impact shifts from T towards W, and this part of the revetment is exposed not only to the direct impact of the current, but also to the undermining effect of strong eddies produced by the irregular outline of the bank. These forces, in connection with the heavy scour in the contracted channel during floods, cause the concave side of the cross-section to take a slope steeper than that of stability for the fine material of which the bed and banks of the river are composed, which results in the bank being undermined and in the mattress settling. This explanation is supported by the fact that on examining the mattress at a low stage of water it was found to be pulled apart near the water-line and in a few instances the ⅜-inch transverse cables broken.

The damage done during the June rise was repaired in November, 1887, as well as the funds available for construction work would admit of, by tearing out or burning the bank mattress where it had been partly undermined, regrading the bank, and constructing 1,400 linear feet of mattress about 37 feet wide extending from a stage of 315 beyond the shore edge of the old mattress, also by covering the sloped bank with stone.

Repairs were also made from *a* to *b*, from *c* to *d*, from *e* to *f*, and from *g* to *h*, at which places the bank mattress had been slightly damaged.

These latter repairs could only be of a light character, on account of a lack of funds, and consisted in placing a shingling of brush fascines, covered with stone, behind the broken mattress, and regrading the bank with shovels and covering it with stone.

Statement giving the cost of the repairs made at Kaw Bend in November, 1887.

Item.	Quantity.	Cost per item.	Total cost.
Brush...cords..	511	$1.75222	$895.38
Stone...cubic yards..	1,234	1.1180147	1,379.63
¼-inch wire cable...pounds..	1,785	.04667	83.30
⅜-inch wire cable...do....	1,720	.05167	88.87
Cost of materials			2,447.18
Cost of labor and subsistence			2,139.64
Tow-boat and dispatch-boat service **Administration and miscellaneous expenses**			2,552.18
Total cost of repairs			7,139.00

In March, 188-, the bank mattress again began to settle between T and R and between O and W.

At the former locality this action was of only temporary duration, and the damage, which was slight, was repaired by the Kansas City, Saint Joseph and Council Bluffs Railroad Company having placed in the break a shingling of brush weighted with stone. These repairs were made by the railroad company, as their track appeared to be in danger of being washed away.

From O to W the revetment has been entirely washed away, and on June 29 the bank had cut back to the line O-N.

The following is a brief review of the history of the works in Kaw Bend: The protection of the bend was begun in 1879, in which year about 4,400 linear feet of light revetment of an experimental character was constructed near the middle of the bend. By October, 1882, about 75 per cent. of this work had been destroyed by the river, but as late as July, 1883, the shape of the shore-line in the concave side of the bend was even and quite favorable for being protected by revetment. The appropriations up to 1882, however, had been made too irregularly, and were too small in amount to do the necessary work for protecting the whole bend.

In the fall of 1882 this part of the river was placed in my charge, and by June 30, 1883, about one and a half miles of bank was protected by revetment. These works were situated near the middle of the bend, where at the time the greatest necessity for them appeared to exist.

Early in 1883 a project for completing the protection of the bend was prepared, but owing to the failure of Congress to make appropriations for rivers and harbors that year, this work could not be proceeded with, and the opportunity for holding the bend at the proper time was lost. The work was not resumed until the spring of 1885, and meanwhile, owing to the extensive erosions in the upper part of the bend, a part of the work constructed in 1882–'83 was flanked by the river and destroyed, and the shape of the bend entirely changed and made unfavorable for revetting.

By a further delay the conditions would probably have become still more unfavorable, and, besides, the interests at stake made it desirable to prevent the formation of a threatened cut-off by the river.

The experience gained by the failure of a part of the Kaw Bend revetment shows that this class of protection work can not be depended on to withstand very sharp impacts of the current or to be effective in bends of short radius, at least when accompanied with such other unfavorable conditions as in this case. It is quite improbable that such a state of things will exist, however, when the protection of bends is taken in hand while they have a comparatively regular outline and are of approximately even curvature. The shore-lines, channels, etc., of 1882 and 1885 at Kaw Bend are shown on Plate V.

East Bottoms repairs.—On account of the extensive erosion of the right bank at East Bottoms during the past few years the river has become so wide that its regimen is unstable, and during middle and low stages of water the channel is divided and constantly shifting.

In the latter part of August, 1887, a reef formed near the lower end of the revetment constructed the preceding June (see Plate III, Fig. 2). A new channel opened around the head of this reef, and impinged on the revetted bank at an angle with its general direction of about 40 degrees. The upper end of the reef gradually cut away and the point of impact correspondingly shifted down-stream; simultaneously the reef widened, reducing the width of the chute and deepening the channel along the bank. This action lasted for about three weeks, and as a result the flexible mattress below the water-line settled, and the bank immediately behind it, from C to D (see Plate III), a distance of about 1,100 feet, was undermined.

As the stage of water decreased the channel above the reef shoaled, the reef was cut away by the current through the chute following the bank, and the undermining of the revetment ceased.

Soundings made September 7 showed the side slopes of the revetted bank below the water to be from 1 on 1¼ to 1 on ⅜. The sketch given on Plate III, Fig. 1, shows the change in shape of the cross-section in the vicinity of the break between July 2 and September 7. Upon examining the mattress at low water it appeared in good condition, with the exception of being torn near the water-line.

The repairs to this work, which were made in November, consisted in burning off the damaged bank mattress, regrading the bank, and constructing a mattress 1,137 feet long by 35 feet wide, extending from an elevation of mid-stage out over the inner edge of the old mattress.

Statement giving the cost of these repairs.

Item.	Quantity.	Cost per item.	Total.
Brush .... cords..	254	$1.75222	$445.07
Stone .... cubic yards..	166	1.1180147	185.59
⅜-inch wire cable .... pounds..	1,674	.04667	78.12
¼-inch wire cable .... do...	1,720	.05167	88.37
Cost of materials	....	....	797.15
Cost of labor and subsistence	....	....	887.73
Tow-boat and dispatch-boat service .... Administration and miscellaneous expenses	....	....	937.50
Total cost of repairs	....	....	2,622.38

A recent inspection of this work showed that it was in good condition.

Strengthening the dike at East Bottoms.—The results accomplished by the dike at East Bottoms, constructed in the spring of 1887, are entirely satisfactory, the chute having been almost entirely silted up by deposits both above and below the dike to a stage of about 314 (K. C. gauge).

The area of accretions above the dike amounts to about 37 acres and below to 41 acres.

wer
for
E
owi
yea
at t
me
the
of t
E
abl
a t

thi
im
co
pr
is
im
Be

Ea
m
ar

m
a
g
a
re
b
b
P

c
o

t
t
2
c

t
f
e

During the fall of 1887, in order to strengthen the dike and to cause the accretions throughout its length to reach a uniform height, those parts of the dike where the deposit was light were filled in with hay rubbish, weighted with sand and refuse stone, at a cost of $365.

If the funds had been available for the purpose it would have been desirable to raise the dike this spring to a stage of ordinary overflow, so as to cause further deposits on top of the present accretions.

REPAIRS TO AND CARE OF PLANT.

In order to be able to store the boats for the winter at Quindaro, Kans., it became necessary to extend the ways and to make considerable repairs, the total cost of which, including all expenses, amounted to $2,773.71. The laying up of the boats, 86 in number, began November 1 and was completed November 26, at a total cost of $3,424.53.

The current repairs of the season consisted of general repairs to barges, including calking, tow-boats, steam-launch *Melusina*, machinery, tools, etc., the total cost of which, including the cost of the maintenance of the machine-boat, administration, etc., was $5,023.88. The total cost of caring for plant throughout the whole year amounted to $8,293.85.

SURVEYS.

A partial survey of the reach was made in July, and a complete survey, including the sounding of 252 cross-sections, during November and December.

All of the works constructed since the spring of 1885 in the vicinity of Kansas City were carefully examined during the past month, and, with the exception of the revetment in Upper Kaw Bend, before referred to, proved to be in good condition.

Very respectfully, your obedient servant,

SAM. H. YONGE,
Division Engineer.

Lieut. Col. CHARLES R. SUTER,
Corps of Engineers, U. S. A.,
President Missouri River Commission.

APPENDIX W W.

BRIDGING NAVIGABLE WATERS OF THE UNITED STATES.

1. Report of the Board of Engineers relative to the construction of certain bridges across the Missouri, Mississippi, and Illinois rivers.
2. Bridge across Staten Island Sound, known as Arthur Kill.
3. Report of Board of Engineers on Senate Bill No. 1850, Fiftieth Congress, first session, to authorize the construction of a bridge across the waters of Arthur Kill at or near the town of Westfield, Staten Island.
4. Highway bridge across that part of the waters of Lake Champlain lying between the towns of North Hero and Alburgh, Vermont.
5. Bridge of the Kansas City, Topeka and Western Railroad Company across Missouri River at Sibley, Missouri.
6. Bridge of the Chicago, Saint Louis and New Orleans Railroad Company across the Ohio River at East Cairo, Kentucky.
7. Free wagon bridge across the Cumberland River near the city of Nashville, Tennessee.
8. Bridge of the Ohio River Railroad Company across Great Kanawha River, near Point Pleasant, West Virginia.
9. Bridge across the channel of the Detroit River, to connect Belle Isle Park with the mainland.
10. International bridge of the Sault Sainte Marie Bridge Company across Sainte Marie River.
11. Bridge of the Nebraska Railway Company across Missouri River at Nebraska City.
12. Combined railway and wagon bridge of the Omaha and Council Bluffs Railway and Bridge Company across Missouri River between Omaha, Nebraska, and Council Bluffs, Iowa.
13. Bridge of the New York and Long Island Bridge Company across the East River between the city of New York and Long Island.
14. Bridge of the Ohio Valley Railway Company across the Tradewater River, Kentucky.
15. Bridge of the Sioux City Bridge Company across the Missouri River at Sioux City, Iowa.
16. Highway bridge of the Central Railway and Bridge Company of Newport, Kentucky, across the Ohio River, between Cincinnati, Ohio, and Newport, Kentucky.
17. Bridges of the Georgia Pacific Railroad Company across the Sunflower and Yazoo rivers.
18. High bridge across the Mississippi River at Dubuque, Iowa.
19. Bridge of the Ohio Connecting Railway Company across the Ohio River, near the mouth of Cork's Run, in Allegheny County, Pennsylvania.
20. Bridge of the Georgia Pacific Railway Company across the Tombigbee River at Waverly, Mississippi.
21. Bridge of the Memphis and Charleston Railroad Company across the Tennessee River at Chattanooga, Tennessee.
22. Bridge of the Kansas City and Memphis Railway and Bridge Company across the Mississippi River at Memphis, Tennessee.
23. Reports respecting interferences with navigation by bridges, causeways, and other structures.

W W 1.

REPORT OF THE BOARD OF ENGINEERS RELATIVE TO THE CONSTRUCTION OF CERTAIN BRIDGES ACROSS THE MISSOURI, MISSISSIPPI, AND ILLINOIS RIVERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 5, 1888.

SIR: I have the honor to return herewith S. 275, a bill "to authorize the construction of bridges across the Missouri River between its mouth and the mouth of Dakota or James River, and across the Mississippi River between the port of Saint Paul, in the State of Minnesota, and the port of Natchez, in the State of Mississippi, and across the Illinois River between its mouth and La Salle, in the State of Illinois, and to prescribe the character, location, and dimensions of the same," and to state in relation thereto that it was referred to a Board of Engineers, a copy of whose report thereon, together with the accompanying papers, are herewith submitted.

It will be seen that the Board has given the subject full and careful consideration; has studied diligently and with great clearness the characteristics and regimen of each of the rivers concerned, and prepared in great detail a bill to meet the requirements of navigation and commerce and at the same time do justice to the bridge interests.

The Board recommends as follows: That all bridges "over the Missouri River above the mouth of the Platte River shall be high bridges with unbroken spans, all spans over the water-way to have a clear channel-way of not less than 300 feet, and a clear head-room of not less than 50 feet above high-water mark."

That all bridges "over the Missouri River below the mouth of the Platte River, and above the mouth of the Kaw River, shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than 400 feet clear channel-way; all other spans over the water-way to have a clear channel-way of not less than 300 feet, and all said spans shall have a clear head-room of not less than 50 feet above high-water mark."

All bridges over the Missouri River below the mouth of the Kaw River shall be high bridges with unbroken and continuous spans, all spans to have a clear channel-way of 400 feet, and clear head-room not less than 55 feet above high-water mark.

All high bridges over the Mississippi River above the mouth of the Missouri and over the Illinois and Des Plaines rivers shall have one or more channel-spans, each having not less than 350 feet clear channel-way, and not less than 55 feet clear head-room above high-water mark, and the clear head-room under other than channel-spans may be less than 55 feet, provided that no part of the superstructure of such spans shall give a less head-room than 10 feet above high-water mark.

All low bridges within the above-mentioned limits shall have two or more draw-openings of not less than 200 feet clear channel-way, and in addition to said draw-openings all said low bridges shall have one or more fixed channel-spans, each having not less than 350 feet clear channel-way, every part of the superstructure of said low bridge to give a clear head-room of not less than 10 feet above high-water mark; provided that all spans of both high and low bridges shall be so located as to afford the greatest possible accommodation to river traffic, and the draw-openings of low bridges shall, if practicable, be located next or near shore; provided, also, that in case of a low bridge, if the physical characteristics of the locality so require, and the interests of navigation be not injured thereby, the lengths of the fixed spans or the number of the draw-openings may be reduced; provided, also, that for any two adjacent draw-openings of 200 feet each one draw-opening of 300 feet may be substituted, if the interests of navigation be not injured thereby; provided, further, that in low bridges over the Illinois and Des Plaines rivers two or more draw-openings of not less than 160 feet each may be permitted.

Ponton bridges similar to the ponton railway bridge at Prairie du Chien, Wis., may also be constructed; provided such bridges shall be provided with a ponton draw giving not less than 400 feet clear channel-way for each navigable channel of the river, and such other openings for passage of rafts and logs as in the opinion of the Secretary of War may be necessary, etc.

Bridges over the Mississippi River between the mouth of the Missouri and northern limits of the city of Saint Louis shall be high bridges with unbroken and continuous spans having one channel-span not less than 500 feet clear channel-way, all other spans to have clear channel-way of not less than 400 feet, all spans to have clear head-room of not less than 55 feet above high-water mark.

Bridges between the Eads's Bridge at Saint Louis and northern limit of the city to be high bridges with unbroken and continuous spans, not less than 500 feet clear channel-way and not less than 55 feet clear head-room above high-water mark. The remaining portion, if any, over the river-bed to have not less than 300 feet clear channel-way, and may have such reduced head-room as may be determined by the Board of Engineers elsewhere provided for.

Bridges over the Mississippi River between Eads's Bridge and mouth of the Ohio River to be high bridges with unbroken spans, one channel-span of not less than 650 feet in the clear, other spans to have not less than 500 feet clear channel-way, and all spans not less than 65 feet above high-water mark.

It will be seen that the Board was unable to decide upon the width of channel-spans for bridges between the mouth of the Ohio River and Natchez, Miss.; but recommends that all other spans shall have a clear channel-way of not less than 600 feet, and that all spans have a clear head-room of not less than 70 feet above high-water mark.

This office approves the recommendations of the Board so far as they apply to all bridges over the rivers enumerated in the bill, except the portion of the Mississippi River below Cairo.

The Mississippi River Commission, in considering a bill to bridge this river at Natchez, recommended not less than 750 feet for the length of the channel-span, and in a report upon a bridge at Memphis, copy herewith, recommended a channel-span of 1,000 feet at that place, the lengths of these spans being determined by the existing local conditions and the necessities of navigation at the localities. The Commission also recommended that both of these bridges should have a clear headway of 75 feet above high water.

This office is of the opinion that all bridges erected over the Mississippi, between the mouth of the Ohio and Natchez, should have at least 75 feet clear headway above high water. As the physical features of the river and its banks vary materially in this portion, it seems impossible to fix upon a length of channel-span which will be sufficient for navigation at all localities without requiring an unnecessary length at some, which would be an undue hardship upon the companies proposing to construct a bridge at these latter places. It is therefore deemed best to leave the length of the channel-span to be required for the consideration and determination, with the approval of the Secretary of War, of the Board of Engineers, provided for in section 19 of the proposed substitute for the bill. It is therefore recommended that section 18 of the same bill be changed to read as follows:

SEC. 18. That all bridges authorized by this act over the Mississippi River between the mouth of the Ohio River and Natchez, Miss., shall be high bridges with unbroken and continuous spans, having at least one channel-span of the width to be prescribed by the Board of Engineer Officers provided for in the following section (19); all other spans over the water-way to have a clear channel-way of not less than six hundred feet, and all said spans shall have a clear head-room of not less than seventy-five feet above high-water mark.

In view of the importance of this report to the general subject of bridging navigable waters it is respectfully suggested that its printing be recommended.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

LETTER OF TRANSMITTAL.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., February 23, 1888.

SIR: I have the honor to forward herewith the report of the Board of Engineer Officers convened by Special Orders, No. 1, Headquarters Corps of Engineers, dated Washington, D. C., January 10, 1888.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF BOARD OF ENGINEERS.

SAINT LOUIS, MO., *February* 23, 1888.

SIR: The Board of Engineer Officers convened by "Special Orders, No. 1," dated "Headquarters Corps of Engineers, United States Army, Washington, D.C., January 10, 1888," to consider and report upon Senate bill No. 275, Fiftieth Congress, first session, met in this city on January 16, 1888, and remained in session till and including January 21. They then adjourned to allow of the collection of further information. The Board met again on the 27th of January and remained in session till and including January 30, when they adjourned *sine die*. During this time the Board have gone very carefully over the bill submitted to them for consideration, and have sought from all available sources information to guide them in their final conclusions. The bill under consideration was prepared, in essentially its present shape, in 1882, and during the period which has elapsed since that date much information and experience have been obtained, not then available, and a good deal of general and special legislation bearing on the general subject has been enacted. The Board have felt that in a general bill, affecting such wide-spread and important interests as the one under consideration, all such matter as experience has shown to be of value should be included. They have, therefore, felt it their duty to recommend many changes in the bill and also to recommend new sections covering points of importance not embraced in the original draught.

The great majority of these changes, at least in the sections noted as "general," are based upon recent general or special laws affecting bridges, notably the general law for bridges over the Ohio River. In all other cases the changes recommended are such as experience has shown to be desirable or necessary. The number of changes and additions recommended has been so great that the Board have rewritten the entire bill, and recommend the inclosed copy as a substitute for the original. In order that the whole matter may be clearly understood, the changes recommended will be noted and explained, section by section, the numbers given referring to the modified bill.

In title.—The upper limit on the Mississippi River, designated as the "port of Saint Paul, in the State of Minnesota," is changed to "mouth of Minnesota River, in the State of Minnesota." This gives a more definite limit and includes the Government landing at Fort Snelling, about 4 miles above the steamboat landing at Saint Paul. It is not thought that this extends the limit beyond the port of Saint Paul, and in any case, the 4 miles of river referred to are as navigable in their natural condition, and as susceptible of improvement, as many portions of the river below Saint Paul.

"Across the Illinois River, between its mouth and La Salle, in the State of Illinois," is changed to "across the Illinois and Des Plaines rivers, between the mouth of the Illinois and the city of Joliet, in the State of Illinois." The present project for the improvement of the Illinois River, upon which the United States Government and the State of Illinois have for many years been engaged, contemplates a system of slackwater navigation with locks 350 feet by 75 feet, as high up as Joliet, thence by canal along the most feasible route yet to be determined on to Lake Michigan. The requirements for navigation will, therefore, be the same from La Salle to Joliet as for the other portions of the Illinois River.

In this connection the Board desires to call attention to the fact that the upper limit for the application of this bill on the Missouri River is fixed at the mouth of the Dakota or James River, in Dakota, and near the town of Yankton, while the lower limit on the Mississippi is fixed at the port of Natchez, Miss. The reason for selecting these limits is not apparent. So far as the Missouri River is concerned there is no change of importance in its physical characteristics until the rocky portion of the stream above Fort Carroll is reached, and the Board are decidedly of the opinion that the provisions laid down for that portion of the stream above the mouth of the Platte should be made applicable as far up as Fort Benton, the head of navigation. With regard to the southern limit on the Mississippi, the Board consider that there is no physical change in the stream of consequence until after Red River is passed, and that the conditions governing bridge construction for the Lower Mississippi would not need modification, at least as far down as Baton Rouge, where the bluffs end, possibly not until New Orleans is reached and ocean shipping met with. Here it is possible that some modification might be necessary or desirable.

Section 1.—In this section has been added, "when public necessity so demands." The Board consider that all bridges, no matter how carefully located or planned, are more or less obstructions to navigation and while it is doubtless proper that the latter interest should give way to a certain extent when a bridge *is* a public necessity, yet it does not seem right that this hardship should be imposed unless the general interests imperatively require it. This consideration is of especial importance in case of the duplication of bridges at any locality. It is a known fact that in several cases the construction of bridges has been contemplated where such construction was not a public necessity, and where the additional obstruction to the interests of navigation would have been serious, without any compensating advantage to the general public.

There has also been added, "at points where said construction will not materially affect the interests of navigation." This clause is found in all the recent bridge acts for the Upper Mississippi River, and is an important one. There are some points where the construction of a bridge would be almost a bar to successful navigation, whereas at other points in the vicinity a bridge would not be so serious an obstruction as to prohibit its construction. In such cases it seems proper that the authority to construct shall only apply to the localities where regard for the navigation interest will best justify the construction. An addition has also been made to the description of the portions of the rivers over which the authority under the bill extends by repeating the limits as given in the title of the bill.

Another addition is as follows, viz, "and hereafter no bridges shall be built over said rivers within said limits, except under said provisions and requirements." Heretofore a number of bridges within the limits contemplated by this act have been erected without the authority of Congress, and no law exists for the prevention of such construction. Many of these bridges have proved serious obstructions to navigation. As the object of the present act is to prevent the unnecessary obstruction of navigation by bridges improperly located or constructed, it would seem proper that such unnecessary obstruction be prevented by prohibiting the construction of all bridges which do not conform to the requirements of this act. Without this requirement it would result that those who obtain authority for their action will be subject to more restrictions than those who do not, and the act will be practically valueless.

Section 2.—Only such changes are made here as were necessary to make the numbers correspond to the sections of the bill as amended by the Board.

Section 3. Some few changes have been made in the definitions of terms of frequent occurrence in the bill, which were considered necessary for a better understanding of the ideas they were intended to express, or where it was thought the language used might give rise to misunderstanding or controversy. Throughout the bill, as now submitted, many changes have been made in the wording in order to have the phraseology correspond with the definitions given in this section.

Section 4.—This section is section 7 of the original bill. The principal change to be noted is that the provision requiring through-spans is left out, as being unnecessary and sufficiently covered by other provisions in the bill.

Section 5 in the original bill is omitted as unnecessary, as the Board consider draw-spans in high bridges undesirable and generally impracticable. This subject is fully discussed in the special sections where it occurs.

Section 5.—This section is section 6 of the original bill. The principal change to be noted is that the Board have attempted to do away with the idea of prescribing how the opening or openings through low bridges shall be made. It is sufficient for navigation purposes to know that an opening or openings of the prescribed width will be available when required for the passage of river craft, and the method of effecting such openings should be left, as far as possible, to the judgment of the builders of the bridge, subject to the revision provided for in this act.

The amended section also requires that draw-openings shall be visible for a distance of not less than one mile above the bridge. Safety requires that descending boats or other craft should be able to know certainly whether the draw is open or shut a sufficient time before reaching it, to admit of stopping or landing, should either be necessary. It also requires that so far as practicable, and when in the interests of navigation, all bridges should be located above important landings. The reason for this lies in the fact that, with a bridge located just below a landing, boats coming to or leaving the same would be in great danger of being injured.

It is further provided, that in certain cases where river craft might obstruct the passage through or under the bridge by landing in too close proximity thereto, the right to do so should be extinguished by the owners of the bridge. This provision occurs in the general bridge law for the Ohio River, and seems to the Board a proper one to introduce here. The additional draws provided for in the bill to accomplish this object would probably be much more expensive and generally impracticable.

Section 6.—In line 11, section 6, of the original bill, for "bridge" has been substituted "span or spans," as there can be no objection to the movement of trains over any portion of the bridge other than the draw-opening. Lines 12 and 13, "or of boats through said draw," is omitted as unnecessary, such delay being considered of extremely improbable occurrence. The rest of the section is unchanged.

Section 7.—This is section 8 of original bill. An additional requirement is introduced to the effect that the axis of the bridge shall be as nearly as may be at right angles to the current. This is deemed important, to prevent the construction of bridges very oblique to the direction of the current, which are not considered safe for navigation. The prohibition of riprap in channel or draw spans is extended to all spans, as experience has shown that its use is never necessary, except as a remedy for improper construction, and its presence always affects the waterway and may unduly increase the velocity of the current at the site of the bridge. This section also requires the removal of this and all other obstructions, under the Secretary of War's direction, by and at the expense of the company or persons owning, controlling, or operating the bridge.

Section 8.—This is a new section intended to regulate the character of the approaches and other parts of the bridge with especial reference to their bearing on the flood discharge of the river.

Section 9.—Is new and covers the case of any bridge erected in the near vicinity of an existing bridge. In this case, if the general requirements were strictly followed, there might result a very serious obstruction to navigation.

Section 10.—This is section 9 of the original bill somewhat amended and enlarged, so as to require the building and maintenance of all such accessory works as may be necessary to overcome, to as great a degree as possible, the obstruction to navigation caused by the construction of bridges. In its present shape the section conforms more closely to existing laws on the subject which it covers.

Sections 11, 12 *and* 13.—These sections replace numbers 10 and 11 of the original bill. The divisions introduced are the mouths of the Kaw and Platte rivers, instead of the Union Pacific Bridge at Omaha. At the points mentioned the influx of large tributaries modifies very materially the size and volume of the river, and will undoubtedly in the future affect considerably the character of its navigation. Above the Platte River the clear channel-way called for is as small as is considered compatible with the free discharge of the river at high stages, and the height is the same as is required by all recent bridge acts. Between the Platte and the Kaw there is an additional requirement of at least one channel-span of not less than 400 feet clear water-way, the height remaining as above. Below the Kaw all spans are to give at least 400 feet clear channel-way, owing to the much greater volume and commercial importance of the river, and the required height is increased 5 feet as the detentions at high stages, due to insufficient height, will be longer, more frequent, and more injurious to navigation than above the Kaw. The lengths of span called for are moderate; in fact, they have been adopted voluntarily in nearly all of the ten bridges which have been built since 1874, owing, it is said, to the saving in cost effected by reducing the number of piers with their costly and difficult foundations.

The Board have omitted the provisions for draw-bridges, as they consider that such structures, dangerous and undesirable in all cases, are entirely inadmissible on the Missouri, where the shifting channels and fierce current require that all possible precautions be taken to prevent bridges from becoming an absolute bar to navigation. This view has been consistently held and urged by the officers in charge of the improvement of this river, and also by the Missouri River Commission. The Board holds that all spans over the water-way should be available for the passage of boats when necessary or desirable, and that these spans should be as long as possible, both for the safety of navigation and for the free discharge of the river at high stages. These conditions can not be complied with in a low bridge. Out of seventeen, the total number of bridges, either built or building over the Missouri, but four are low bridges, and all these were constructed prior to 1875. All four are difficult and dangerous of passage, two in fact being well-nigh impassable at high stages, while at the two others navigation has been several times entirely suspended, owing to the shifting of the channel from under the draw-spans at low water. Since their construction, ten other bridges have been built, all high, although the alternative of a low bridge was allowed. The motive for this is said to have been economy. It would seem, therefore, altogether unjustifiable to authorize a class of bridges, which, if built, would be a constant menace to navigation and which seem to be rarely demanded even on the score of economy.

Section 14.—This section is a substitute for numbers 12, 13, and 18 of the original bill. The general character of the boats to be accommodated on the Mississippi River above the mouth of the Missouri and on the Illinois River is essentially the same, and the requirements for safe navigation would seem to be about identical. The clear headway required of 55 feet is such as is given by existing high bridges over the Upper Mississippi and is the least height that will accommodate the interests of navigation. The height of pilot-houses and other portions of Upper Mississippi steamers have already been reduced to conform to present conditions, and further reduction is impracticable. In many of the bridges over the Upper Mississippi draw-openings of 160 feet and channel or raft spans of 250 feet are provided, but as each bridge furnishes its individual share of obstruction, dimensions heretofore used should not be taken as a guide for future construction. With a view to reducing the expenses of navigation to a minimum, and also owing to the fact that the improvement of navigation has made it possible, the size of rafts has been materially increased of late, and existing bridges are found to be much greater obstructions and to cause more delay and expense than formerly. As the advance in the science of bridge building renders the construction of draw-spans with 200 feet openings and other spans of 350 feet length simple matters, it is thought that the increased dimensions suggested are quite reasonable, and are the least that will properly accommodate present and prospective river traffic.

The section also permits the construction of such inclined highway bridges as are now in successful use at Dubuque and Saint Paul, and which will doubtless be desired elsewhere in the near future. The original sections did not permit their construction.

Provision is also made for all cases in which a narrow river, or other causes, may permit a reduction of the requirements without injuring the interests of navigation.

For the Illinois River, where the difficulties of navigation are not so great and where the rafting interest has not to be considered, draw openings of 160 feet are permitted.

The next four sections pertain to the Mississippi below the mouth of the Missouri, over which there is as yet but one bridge, that at Saint Louis. The corresponding sections of the original bill allow draw-bridges to within 8 miles of the Saint Louis Bridge, and below Saint Louis draw spans in all high bridges are required. These features do not meet with the approval of the Board, and are omitted from the proposed substitutes for these sections. The Mississippi, below the junction of the Missouri, partakes mainly of the characteristics of that stream, with the additional feature of greatly increased volume. Instead of the gentle current and comparatively fixed channels of the Upper Mississippi and Illinois, we find an impetuous current and great instability of channel. Hence, all the objections urged against draw-bridges on the Missouri apply with equal force here, greater, in fact, because the navigation interests are more extensive, great rafts and tows must be provided for, and below Saint Louis the boats employed are much larger. The report of the Board which examined into the question of a bridge recently proposed above the Eads bridge at Saint Louis (Senate Ex. Doc. No. 20, Forty-ninth Congress, second session), gives at length the reasons why low bridges between the mouth of the Missouri and the Eads bridge are considered inadmissible, and in this conclusion the present Board fully concur. The draws called for in high bridges below the Eads bridge the Board consider highly objectionable. Their only object, apparently, would be to enable boats having tall chimneys to get through the bridge without lowering them, at times when the stage of water would not admit of their passing under the fixed spans. But it is only at high stages that any inconvenience from this source would be experienced, and at such times the strong current would render the passage of a heavily-laden boat through a narrow draw opening an extremely hazardous, if not impracticable, operation. On the other hand, the extra cost entailed upon the construction of the bridge by additional piers and expensive draw-spans, would be a heavy and very distasteful item. Therefore, as they consider that the value of these draw-spans to navigation would be little or nothing and the extra cost entailed by their construction unnecessary, they have recommended their omission from the requirements. The Board feel well assured that, by the use of well-known appliances, the upper portions of steam-boat chimneys can be lowered to the level of the pilot-houses, and as the clear head-room they have recommended will pass the pilot-houses of the largest boats on the river, they consider that the slight delay which may accompany this operation of lowering the chimneys will be far less onerous to navigation than the great danger and difficulty which must, of necessity, attend an attempt to pass through a narrow draw opening at high stages of water.

Section 15 corresponds to section 14 of the original bill. The channel-span of not less than 500 feet called for is deemed necessary for the passage of rafts, which are already made up in widths exceeding 400 feet. The other spans over the water-way should be of not less than 400 feet to avoid undue contraction of the water-way. The head-room of 55 feet called for is the same as that now required for bridges over the Upper Mississippi River, to which the heights of all up-river boats have been gauged. The southern limit is taken to the northern limit of Saint Louis, so as to embrace in the next section all of the har bor north of the Eads Bridge.

Section 16 corresponds to section 15 of the original bill. It provides that all spans over the water way of the harbor of Saint Louis, as it will be when its improvement is completed, shall give at least as much accommodation to navigation as do those of the Eads Bridge, and also the same head-room as is given by the bridges over the Upper Mississippi. Any additional spans required to cross the present river-bed may be of less length and height.

Section 17 corresponds to section 16 of the original bill. After passing below Saint Louis, it becomes necessary to provide for larger boats than are employed above that city, and also for the immense grain-tows which go down the river. The Board consider that 500 feet is the least width allowable for any span over the water-way, and that a clear head-room of 65 feet above high-water mark is needed to pass the pilot-houses of the large packets running to Saint Louis. To accommodate the large tows, they consider that a channel-span of 650 feet is the least admissible, and that this width may have to be increased in special cases, at the discretion of the Board of Engineer Officers elsewhere provided for. To understand the necessity of this great width of span, the size of tows and the manner of handling them must be explained. The diagram annexed to this report shows a tow made up of seven barges and a tow-boat. Each barge is 235 feet long by 41 feet beam, and carries, when the stage of water permits, 50,000 bushels of wheat, or 1,500 tons of that or other freight. The whole tow, including the steamer, which is firmly fastened to the barges in the position indicated, measures 660 feet in length and 205 feet in breadth. The barges, with their upper works or cargo-boxes, expose about 15 feet of height above the surface of the water. In descending the stream, if the channel is straight, the tow-boat pushes the tow along, but if the channel is crooked, especially if the current is strong, the limit of capacity of steering by means of the rudders of the steamer is soon reached. When this is the case the engines are reversed and the stern of the boat thrown away from the concave shore. The tow then lies more or less obliquely to the current and is carried on by it, the tow-boat meanwhile, by backing when necessary, preserving a safe distance between the tow and the bank. The degree of obliquity of the tow to the current depends upon the velocity of the latter and the degree of curvature of the channel; in extreme cases it may be absolutely at right angles to the current. This operation is technically known as flanking, and with the tortuous channels and sweeping bends of the lower river is of almost constant occurrence. Owing to the extent of surface exposed to its action, the effect of wind on one of these unwieldly tows is also very great, and for all these reasons it is necessary, to insure safety, that the channel-spans of bridges through which they are expected to pass, should considerably exceed the width of the tows, and in extreme cases even their length, to provide against the contingency of their arriving at the bridge broadside on.

Section 18.—This is section 17 of the original bill. Below the junction of the Ohio the Mississippi is more than doubled in volume, and demands corresponding care in avoiding undue encroachment on its water-way. The character of its navigation is also different and demands greater facilities. We meet here not only the large grain tows, already spoken of as leaving Saint Louis, but also the immense coal tows from the Ohio River. Diagrams appended show the arrangement and size of some large coal-tows reported to the Board. The larger of these, that of the *Joseph B. Williams*, comprises thirty-nine boats and barges, carrying in all 821,640 bushels, or about 32,865 tons of coal The dimensions of this tow were—length, including tow-boat, 1,032 feet; breadth, 256 feet. The other diagram shows a tow of forty-one pieces.

It is 904 feet in total length, by 310 feet in breadth, and its cargo consists of 764,546 bushels of coal, weighing 30,581 tons.

These are, of course, large tows, but not exceptionally so, and the tendency, is to still further increase their dimensions. They are handled in essentially the same manner as already described when speaking of the preceding section, but owing to their great size and weight, and the tortuous course of the stream, the operation of flanking is in almost constant requisition. Owing to the increase in the volume of water, as well as in the demands of navigation, the Board consider it necessary that the length of all spans should be made greater than above Cairo. The clear head-room should also be increased for several reasons. First, on the lower portions of the river, at least, a larger class of boats is used; second, the duration of high water is much longer, the river, at times of flood, remaining for days and even weeks in close proximity to extreme high-water mark, hence detention due to insufficient height would be more frequent and of longer duration; third, the present high-water marks are no safe criterion for the future, since the general leveeing of the river front, now rapidly progressing, is certain to make many changes, and will probably result in at least a temporary raising of flood levels. The Board are of the opinion that no spans over the water-way of less than 600 feet should be allowed, and that the clear head-room should not be less than 70 feet above high-water mark. They have left blank the least width of channel-span allowable, since, being evenly divided on the subject, they have been unable to reach a conclusion. Majors Mackenzie and Handbury consider that 700 feet might in certain cases be sufficient, while Lieutenant-Colonel Suter and Major Miller deem 800 feet the least that under any circumstances should be allowed. The Board are, however, unanimous in their opinion that the widths allowed by the bill, of 500 feet and 600 feet, are entirely inadequate, and that greater widths even than 800 feet will probably be required for many of the special localities where bridges are most likely to be erected. This matter was carefully considered by the Mississippi River Commission in the case of a proposed bridge at Memphis, and their conclusion and recommendation, based on actual observations on coal tows passing the town, was that a channel-span of at least 1,000 feet clear waterway was required at that place. (See copy of report dated May 14, 1884, hereto appended.)

Section 19 of this bill gives to the Board of Engineers, therein provided for, ample authority to call for such width of channel-span as the necessities of each special case considered may demand.

Section 19 of the original bill is omitted. Its provisions could not be of general application, and are thought to be sufficiently covered by other sections of the bill.

Section 19.—This is section 20 of the original bill, which was founded on the first Ohio River bridge act, approved December 17, 1872. The section has been re-written and is now based on the new Ohio River bridge act, approved February 14, 1883. The additions to this act, not including minor changes, which do not affect the requirements, are that the Secretary of War is given authority, on the recommendation of a Board of Engineers, to refuse permission to construct a bridge in any special locality if it is not a public necessity, or, if erected under the special conditions and circumstances pertaining to the locality, would be an insuperable obstruction to navigation. The new section is also a little more full in its requirements as to accessory works, which experience has shown to be especially necessary in the case of bridges on the Upper Mississippi and Illinois rivers, where the spans are comparatively small. The section authorizes, on the recommendation of the Board of Engineers, such changes in the general requirements of this act as may be rendered necessary by the physical characteristics of the locality, or that can be made without injury to the interests of navigation. This proviso seems necessary, as otherwise the general requirements which in most cases would be sufficient might prohibit a bridge in some special locality where variation might be allowed without injury to any one, while in other cases such variations might be absolutely indispensable to the safety of navigation.

The section also requires the proper maintenance of both bridges and their accessory works. Experience has shown that these may be built in accordance with the requirements of law, but not so maintained and kept in repair as to prevent the unnecessary obstruction naturally resulting from letting various parts of the structures go to ruin.

Section 20.—This is a new section, based mainly on existing laws, and prescribes the mode of procedure in case of the failure of parties owning, controlling, or operating bridges to comply with the provisions of this act. The Board deem this a very important section and most necessary for protecting the interests of navigation.

Section 21 is essentially the same as the like numbered section in the original bill. There has been added a requirement in the case of low bridges for showing the stage of water, as is now done at most existing bridges, to the great advantage of the interests of navigation.

Section 22 is the same as the old section, with some minor changes in the wording.

Section 23 is unchanged from the original.

Section 24.—A proviso has been added to the original section prohibiting the reduction of head-room or channel-way by the constructions authorized in the section.

Section 25.—This is the first part of section 25 of the original bill. It has been slightly extended to make it more full and explicit, the additions being taken from existing laws. It also provides for the proper supervision of any work required under this section.

Section 26.—This is a new section, which provides for a general supervision of the construction of bridges by the Secretary of War, and for the prevention of unauthorized changes and deviations from the plans that have been properly approved. It also provides that, during construction, navigation at the bridge site shall not be restricted or interfered with to a greater extent than is absolutely necessary. The Board is of opinion that such a proviso is necessary in order to secure the execution of the provisions of this act, as without proper supervision the approved plans may be so deviated from in their execution as to affect injuriously the interests of navigation.

Section 27.—This is a new section, which fixes a time limit for the commencement and completion of work. Such a limit can work no hardship to parties actually intending to construct a bridge, and it is necessary in order to prevent the holders of a permission to build from using it for speculative or obstructive purposes.

Section 28.—This is a new section, repealing all former acts or parts of acts authorizing the construction of bridges within the limits covered by this act, upon which construction has not actually begun. This action is considered absolutely necessary as there are now in existence many such acts, some of them very old, and providing entirely inadequate protection for the navigation interests. This general act has been more carefully drawn than any previous special acts, and as its main object is to guaranty in the future the construction of properly designed bridges, it would be unjust to parties building under its provisons, and to the navigation interests as well, to allow an improper class of bridges to be built, under the provisions of some old charter not sufficiently guarded in its requirements. It is believed that in all the acts alluded to, the right to amend or appeal was expressly reserved by Congress.

Section 29.—This is the latter part of section 25, and contains the usual provision reserving the right to amend, alter, or repeal this act, and also to require the removal of any bridge constructed under its provisions, when the public interests so require.

The following papers are appended to this report: Copy of minutes of proceedings of the Board: Copy of bill as amended by the Board

The following papers referred to the Board for their information are herewith returned: Bill S. 275; copies of indorsements of the Chief of Engineers and of the War Department upon the subject; six printed copies of a proposed act authorizing the construction of bridges "across the Missouri, Mississippi, and Illinois rivers, and prescribing the character, location, and dimensions of the same," received from Mr. E. W. Gould, of the committee of the Merchants' Exchange of Saint Louis, Mo.. together with the reports of the officers to whom they were referred, and copies of letter of the Chief of Engineers, dated May 11, 1882, reporting upon a similar bill (S. 1679), and of amended bill submitted therewith, and also copy of Senate Ex. Doc. 20, Forty-ninth Congress, second session, containing report of the Board of Engineers relative to bridging the Mississippi River at or near Saint Louis, Mo.

Very respectfully, your obedient servants,

CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.
A. MACKENZIE,
Major of Engineers, U. S. A.
A. M. MILLER,
Major Corps of Engineers.
THO. H. HANDBURY,
Major of Engineers, U. S. A.

The undersigned, while agreeing fully with everything presented in the foregoing report, deem that some further remarks on the subject of bridging the Mississippi below the mouth of the Ohio are needed for a full understanding of the question involved.

The vast number of bridges erected in the last twenty years enables us to form a very definite opinion of the requirements as to site which are likely to be sought for. These are, first and foremost, small width of water-way and stability of banks and channel. For instance, no one would expect a bridge-builder to choose a site where the crossing of 10,000 feet of water-way would be required, when other sites having only from 2,000 feet to 3,000 feet of water-way were available. Yet this is just the choice which would be presented on the Lower Mississippi, and which narrows down the question of possible sites to a comparatively few and well-known localities. Furthermore, the narrow places, being in the vicinity of bluffs or slowly-yielding banks, offer the additional advantage of comparative stability of both banks and channel, while the proximity of bluffs is an important factor in the question of approaches to a high bridge. At all places where the water-way is much in excess of 3,000 feet, unstable channels and caving banks are the rule; hence such sites would very likely be tinguish the right to obstruct the entrance to said draw-opening or span for a distance of at least seven hundred feet above and seven hundred feet below the bridge.

SEC. 6. That all draw-spans authorized by this act shall be operated by steam or other reliable mechanical power, and shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over said span or spans; but in no case shall unnecessary delay occur in opening said draw after the passage of trains; and also, that in case the opening of a draw is delayed by reason of the passing of a train after the signal has been given from a boat ready to pass through, the draw shall be opened for the passage of such boat before another train is allowed to pass over the said span or spans; nor shall there be any unnecessary delay in the passage of trains over the bridge.

SEC. 7. That all piers shall be built parallel with the current of the river at that stage of water which is most important for navigation; and the bridge itself shall be built as nearly as may be at right angles thereto; and that riprapping or other protection for imperfect foundations which will lessen the required water-way shall not be permitted; also that piers which will produce cross-currents or bars dangerous to navigation shall not be constructed; and if after construction any piers or accessory works are found to produce the above-mentioned effects, or if any riprapping or other protection prohibited by this section is found to exist, the nuisance shall be abated or corrected under the direction of the Secretary of War or at the expense of the company or persons owning, controlling, or operating said bridge.

SEC. 8. That, in the case of all bridges built under the provisions of this act, the approaches to the bridge shall be so designed and constructed as not to interfere with the free discharge of the river in seasons of flood; and any encroachment on the high-water cross-section by piers, solid embankments, or otherwise, which will result in unduly accelerating the high-water current at the site of the bridge shall not be allowed.

SEC. 9. That, if the interests of navigation so require, the clear channel-ways of any proposed bridge located in the immediate vicinity of an existing bridge may be made to correspond in length and location of spans to the clear channel-spans of said existing bridge.

SEC. 10. That any persons or company constructing any bridge under authority of this act shall build and maintain at all times as accessory works to such bridge, such booms, piers, dikes, guard fences, and similar devices as may be necessary to insure at all times a permanent channel for a sufficient distance above and below the bridge site, and for the guiding of rafts, steam-boats, and other water craft safely under or through said bridge; and if at any time after the construction of the bridge and its accessory works the approaches to draw openings, channel-spans, or raft passages in bridges over the navigable waters referred to in this act are found to be dangerous or difficult of access by any important class of river traffic, the Secretary of War may, upon the recommendation of the Chief of Engineers, United States Army, order the company or persons owning, controlling, or operating said bridge to construct under his direction, and to maintain, such additional sheer-booms, dikes, and other devices as will obviate the difficulty mentioned, which additional sheer-booms, dikes, and other devices shall be built and maintained at their own expense by said company or persons.

SEC. 11. That all bridges authorized by this act over the Missouri River above the mouth of the Platte River shall be high bridges with unbroken and continuous spans, all spans over the water-way to have a clear channel-way of not less than three hundred feet, and a clear head-room of not less than fifty feet above high-water mark.

SEC. 12. That all bridges authorized by this act over the Missouri River below the mouth of the Platte River and above the mouth of the Kaw River, shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than four hundred feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than three hundred feet; and all said spans shall have a clear head-room of not less than fifty feet above high-water mark.

SEC. 13. That all bridges authorized by this act over the Missouri River between its mouth and the mouth of the Kaw River shall be high bridges with unbroken and continuous spans, all spans over the water-way to have a clear channel-way of not less than four hundred feet, and a clear head-room of not less than fifty-five feet above high-water mark.

SEC. 14. That all high bridges over the Mississippi River above the mouth of the Missouri, and over the Illinois and Des Plaines Rivers, authorized by this act, shall have one or more channel-spans, each having not less than three hundred and fifty feet clear channel-way, and not less than fifty-five feet clear head-room above high-water mark, and the clear head-room under other than channel-spans may be less than fifty-five feet: *Provided*, That no part of the superstructure of such spans shall give a less head-room than ten feet above high-water mark: *And provided further*, That the interests of navigation be not injured by such reduction in height. That all low bridges within the above-mentioned limits shall have two or more draw-openings, each having not less than two hundred feet clear channel-way; and in addition to said draw-openings, all said low bridges shall have one or more fixed channel-spans, each having not less than three hundred and fifty feet clear channel-way; and every part of the superstructure of said low bridges shall give a clear head-room of not less than ten feet above high-water mark: *Provided,* That all spans of both high and low bridges shall be so located as to afford the greatest possible accommodation to the river traffic, and a draw-opening of low bridges shall, if practicable, be located next or near shore: *Provided also,* That, in case of a low bridge, if the physical characteristics of the locality so require, and the interest of navigation be not injured thereby, the lengths of the fixed spans or the number of draw-openings may be reduced: *Provided also,* That for any two adjacent draw-openings of two hundred feet each, one draw-opening of three hundred feet may be substituted, if the interests of navigation be not injured thereby: *Provided further,* That in low bridges over the Illinois and Des Plaines Rivers, two or more draw-openings of not less than one hundred and sixty feet each may be permitted: *Provided further,* That on the Mississippi River above the mouth of the Missouri, and on the Illinois and Des Plaines Rivers, bridges may be constructed as pile and ponton bridges, similar to the ponton railway bridge at Prairie du Chien, Wisconsin, legalized by act of Congress approved June six, eighteen hundred and seventy-four; and such bridges shall be provided with a ponton draw, giving not less than four hundred feet clear channel-way for each navigable channel of the river, and such other openings for the passage of rafts and logs as in the opinion of the Secretary of War may be necessary: *And provided further,* That pile and ponton bridges shall be subject to all the restrictions of this act as regards plans, location, and accessories, as provided for in case of high and low bridges, so far as they are applicable to such kind of bridge.

SEC. 15. That all bridges authorized by this act over the Mississippi River between the mouth of the Missouri River and the northern limits of the city of Saint Louis, Missouri, shall be high bridges with unbroken and continuous spans having at least one channel-span of not less than five hundred feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than four hundred feet; and all said spans shall have a clear head-room of not less than fifty-five feet above high-water mark.

SEC. 16. That all bridges authorized by this act over the Mississippi River between the Eads Bridge over said river at Saint Louis, Missouri, and the northern limit of said city shall be high bridges with unbroken and continuous spans, and shall have over that portion of the river-bed embraced between the wharf-line of the city of Saint Louis as now established, or as may hereafter be established within the limits specified, and a line parallel thereto, and fifteen hundred feet distant therefrom, spans of not less than five hundred feet clear channel-way, and having not less than fifty-five feet clear head-room above high-water mark. The spans over the remaining portion, if any, of the river-bed shall have not less than three hundred feet clear channel-way, and may have such reduced head-room as in the opinion of the Board of Engineers, elsewhere provided for in this act, will not be prejudicial to the interests of navigation.

SEC. 17. That all bridges authorized by this act over the Mississippi River between the Eads Bridge at Saint Louis, Missouri, and the mouth of the Ohio River shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than six hundred and fifty feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than five hundred feet; and all said spans shall have a clear head-room of not less than sixty-five feet above high-water mark.

SEC. 18. That all bridges authorized by this act over the Mississippi River between the mouth of the Ohio River and Natchez, Mississippi, shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than —— feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than six hundred feet, and all said spans shall have a clear head-room of not less than seventy feet above high-water mark.

SEC. 19. That any authorized person, company, or corporation intending to construct a bridge under the provisions of this act shall give notice for two weeks of such intention, stating the kind of bridge and exact location by publication in papers having a wide circulation in the cities of Saint Louis, Saint Joseph, and Kansas City, in the State of Missouri, Atchison and Leavenworth, Kansas, and Omaha in Nebraska, concerning bridges to be built over the Missouri River; and in newspapers published and having a wide circulation in the cities of Saint Louis, Missouri, Chicago, Quincy, and Peoria, Illinois, Keokuk, Davenport, and Dubuque, Iowa, La Crosse, Wisconsin, and Saint Paul, Minnesota, for bridges over the Mississippi River above Saint Louis, or over the Illinois and Des Plaines Rivers; and in newspapers published and having a wide circulation in Pittsburgh, Cincinnati, Louisville, Saint Louis, Memphis, and New Orleans for bridges over the Mississippi River below Saint Louis; and shall submit to the Secretary of War, for his examination, a design and drawings of the bridge, piers, approaches, and accessory works and a map of the location, giving, for the space of at least three miles above and one mile below the proposed location, the topography of the banks of the river and the shore-lines at high and low water. This map shall be accompanied by others drawn on the scale of one inch to two hundred feet, giving for a space of one-half a mile above the line of the proposed bridge and a quarter of a mile below, an accurate representation of the bottom of the river, by contour lines two feet apart, determined by accurate soundings, and also showing over the whole width of this part of the river the force and direction of the currents at low water, at high water, and at least one intermediate stage, by triangulated observations on suitable floats. The maps shall also show the locations of other bridges in the vicinity, and shall give such information as the Secretary of War may require for a full and satisfactory understanding of the subject. Said maps and drawings shall be referred to a Board of officers of the Corps of Engineers, United States Army, for examination and report, which Board shall personally examine the site of the proposed bridge and shall hold a public session at some convenient point to hear all objections thereto, of which public session due notice and invitation to be present shall be given to all interested parties by advertising, and such parties shall be allowed sufficient time for a full examination and consideration of plans; and if said Board of Engineers reports that the bridge is not a public necessity or that the location selected is unsuitable for a bridge, or the plans presented are unfavorable to the interests of navigation at the site proposed, the Secretary of War is authorized, on recommendation of said Board, to refuse permission for construction of a bridge on the proposed location or to order such changes in the design of the bridge or the location of its piers as may be deemed necessary; and the construction of such dikes, booms, piers, or other structures as may be needed for confining the flow of water to a permanent channel for a distance of not less than one mile above the bridge site and a proper distance below, and for guiding rafts, steam-boats, and other watercraft safely under said bridge or through the draw and raft spans, at the expense of the parties constructing such bridge; but in no case shall there be a reduction in the number, width, or head-room of draw, raft, or channel span, or in the arrangement and length of accessory works required by this act, unless such reduction is made necessary by the physical characteristics of the river in the locality where the building is proposed or is shown clearly to be not injurious to the interests of navigation; and the proposed bridge shall only be a legal structure when built in accordance with the plans as recommended by the said Board of Engineers and approved by the Secretary of War, and while so managed and kept in repair as to offer at all times reasonable and proper means for the passage of rafts, steam-boats, and other watercraft through or under said bridge, and only so long as all the requirements of this act are observed.

SEC. 20. That whenever the Secretary of War has good reason to believe that any of the provisions of sections 7, 10, and 25 of this act have not been complied with by any persons or company owning, controlling, or operating a bridge authorized under the provisions of this act, it shall be the duty of the Secretary of War, on satisfactory proof thereof, to require the said persons or company to comply with the provisions of said sections, and, on failure of said persons or company to comply with said requirements within a reasonable time, the Secretary of War shall proceed to cause the necessary work, in the form of additions, alterations, repairs, or removal of obstructions, to be made at the expense of the United States and shall refer the matter, without delay, to the Attorney-General of the United States, whose duty it shall be to institute, in the name of the United States, proceedings in the circuit court of the United States of any State in which any portion of said obstruction or bridge touches, for the recovery of the cost thereof, and all moneys accruing from such proceedings shall be covered into the Treasury of the United States: *Provided*, That in the construction of additional accessory works not contemplated by the approved plan of bridge and accessory works, no greater sum than fifteen thousand dollars shall be required to be expended upon any one bridge in a single year: *And provided further:* That such sum of money as may be necessary to execute the provisions of this section is hereby appropriated out of any money in the Treasury of the United States not otherwise appropriated, to be paid on the requisition of the Secretary of War.

SEC. 21. That any companies or persons owning, controlling, or operating bridges authorized by this act shall maintain at their own expense from sunset to sunrise throughout the season of navigation such lights and other signals on the bridges as may be required by the Light-House Board for the security of navigation; and shall also, during the season of navigation, have posted in a conspicuous place on or near all high bridges the clear head-room under the channel-span on that day, the figures expressing this height to be readily visible to the naked eye from any point in the channel of the river for a stretch of four thousand feet, of which three thousand feet shall be above and one thousand feet shall be below the channel-span of the bridge; and shall display on all low bridges at points plainly visible to boats passing through the draw a record showing the stage of water and whether the river is rising or falling.

SEC. 22. That any bridge constructed, maintained, and operated under this act and according to its limitations shall be a lawful structure and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transportation over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation of said mails, troops, and munitions over the railroads and public highways leading to said bridge; and the United States shall have the right of way for postal telegraph purposes over any such bridge; and in case of any litigation arising from any alleged obstruction to the navigation of any of said rivers, created by the construction of any bridge under this act, the cause or question arising may be tried before the circuit court of the United States of any State in which any portion of said obstruction or bridge touches.

SEC. 23. That all railroad companies desiring the use of any bridge constructed under this act shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 24. That the persons or corporations constructing bridges under the provisions of this act shall have the right to construct safe and suitable passage-ways thereon for foot-passengers and vehicles of every description, and to charge a reasonable toll for the use thereof; but the rates of toll shall be submitted to the Secretary of War and shall be subject to his approval or to any change he may think proper from time to time in such rates; and provided that the constructions authorised by this section shall not reduce the clear head-room or clear channel-way required by the provisions of this act.

SEC. 25. That such alterations and changes as may be required by the Secretary of War, or Congress, in bridges constructed under the provisions of this act, so as to preserve free and convenient navigation, shall be made under the direction of the Secretary of War and at their own expense by the company or persons owning, controlling, or operating said bridges.

SEC. 26. That all bridges constructed under the authority of this act shall be built under the general supervision of the Secretary of War, and no changes or alterations in plans shall be made during construction of said bridges or after their completion, unless said changes or alterations conform to the provisions of this act and are authorized by the Secretary of War. That during original construction or in carrying out any authorized changes or repairs of said bridges, a navigable channel shall be preserved at the site of the bridge at all times, and the water-way of the river shall not be obstructed to a greater extent than is absolutely necessary, and such lights and buoys shall be kept on all coffer-dams, piles, etc., as may be necessary for the security of navigation.

SEC. 27. That any permission granted by the Secretary of War under the provisions of this act for the construction of a bridge shall be null and void if said construction be not actually commenced within one year and completed within three years from the date of said permission.

SEC. 28. That all former acts or parts of acts granting authority for the erection of any bridge or bridges over the portions of the rivers set forth in section 1 of this act, be, and the same are hereby repealed, in each and every case where actual construction of said bridge or bridges be not commenced on or before the date on which this bill becomes a law.

SEC. 29. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require the entire removal of any bridge constructed under the provisions of this act, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it is also expressly reserved.

PROCEEDINGS OF BOARD.

SAINT LOUIS, MO., *January* 16, 1888.

Proceedings of a Board of Engineers, convened by virtue of the following order:

Special Orders, }
No. 1. }

HEADQUARTERS CORPS OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 10, 1888.

By direction of the Secretary of War a Board of officers of the Corps of Engineers, to consist of Lieut. Col. Charles R. Suter, Maj. Alexander Mackenzie, Maj. Alexander M. Miller, Maj. Thomas H. Handbury, with First Lieut. Theodore A. Bingham, recorder, will assemble in Saint Louis, Mo., as soon as practicable, to consider and report upon the construction of bridges across the Missouri River between its mouth and the mouth of the Dakota or James River; across the Mississippi River between Saint Paul, Minn., and Natchez, Miss., and across the Illinois River between its mouth and La Salle, Ill.

Upon the completion of the duties assigned them Majors Mackenzie and Handbury will return to their stations.

The journeys required under this order are necessary for the public service.

By command of Brig. Gen. Duane.

CHAS. W. RAYMOND,
Major of Engineers.

The Board met, in obedience to notification from its president, at 10 a. m. Present all the members and the recorder.

The president read the order convening the Board, as above, also the letter of instructions to the Board from the Chief of Engineers, as follows:

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 10, 1888.

SIR: The inclosed bill, S. 275, to authorize the construction of bridges across the Missouri River, the Mississippi River, and the Illinois River, etc., is transmitted for the information and consideration of the Board of Engineers constituted by Special Orders No. 1, Headquarters Corps of Engineers, current series, of which you are the presiding officer. Copies of indorsements of the Chief of Engineers and of the War Department upon the subject are also inclosed for the information and guidance of the Board.

It is desired that the Board give the subject the careful consideration which the importance of the interests involved demand, and that it indicate upon the bill such amendments as may be deemed advisable and for the best interests of the rivers concerned.

In connection with the subject the following papers are transmitted for the information of the Board:

Six printed copies of a proposed "act authorizing the construction of bridges across the Missouri, Mississippi, and Illinois rivers, and prescribing the character, location, and dimension of same," received from Mr. E. W. Gould, of committee of the Merchants' Exchange of Saint Louis, Mo., together with reports of the officers to whom they were referred, and copies of letter of the Chief of Engineers dated May 11, 1882, reporting upon a similar bill, S. 1679, and of amended bill submitted therewith, and also copy of Senate Ex. Doc. No. 20, Forty-ninth Congress, second session, containing report of the Board of Engineers relative to bridging the Mississippi River at or near Saint Louis, Mo.

Maj. A. M. Miller, Corps of Engineers, will pay the expenses of the Board from the appropriation for improving Mississippi River from mouth of the Illinois to the mouth of the Ohio River, etc.

By command of Brig. Gen. Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. CHAS. R. SUTER,
Corps of Engineers.

The indorsements by the Chief of Engineers and Secretary of War, transmitting Senate bill 275, December 12, 1887, were then read:

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 9, 1888.

Respectfully returned to the Secretary of War.

The within bill, S. 275, "to authorize the construction of bridges across the Missouri River, between its mouth and the mouth of the Dakota or James River, and across the Mississippi River, between the port of Saint Paul, in the State of Minnesota, and the port of Natchez, in the State of Mississippi, and across the Illinois River, between its mouth and La Salle, in the State of Illinois, and to prescribe the character, location, and dimensions of the same," has been received, and after careful examination, it has been found that the interests involved in the provisions are so important that before expressing the opinion of this office it is deemed advisable that it be considered by a Board of Engineer Officers, whose large experience has rendered them familiar with the navigation of the rivers and the requirements of commerce affected by the bill.

It is accordingly recommended that the bill be referred to a Board of Officers of the Corps of Engineers, to consist of Lieut. Col. Charles R. Suter and Majs. Alexander Mackenzie, A. M. Miller, and Thomas H. Handbury, with Lieut. T. A. Bingham, recorder.

The Board to meet at Saint Louis, Mo., as soon as practicable, to report upon the provisions of the bill in question.

If approved by the Secretary it is further recommended that the order convening the Board be issued from this office.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

Approved as recommended by the Chief of Engineers.
By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

WAR DEPARTMENT, *January* 10, 1888.

The following telegram was laid before the Board:

NEW YORK, *January* 14, 1888.

Have written you to-day about Vest's bill for bridging Western rivers; please do not decide until you receive letter.

E. L. CORTHELL.

Col. CHAS. R. SUTER.

Senate bill 275 was then read and discussed.
Adjourned at 4.20 p. m. to meet to-morrow at 10 a. m.

SAINT LOUIS, MO., *January* 17, 1888.

Board met at 10 a. m. pursuant to adjournment.
Present all the members and the recorder.
Minutes of yesterday's meeting were read and approved.
Major Mackenzie offered the following resolution:

Resolved, That in the opinion of this Board the following should be added to Senate bill 275, December 12, 1887, as a new paragraph:

That all former laws or parts of laws authorizing the construction of bridges over the Missouri, Mississippi, or Illinois Rivers in conflict with this act and under the authority of which actual construction has not yet been commenced, are hereby repealed.

Seconded by Major Miller. Carried.

Discussion of Senate bill 275 was then begun by sections.

Title. No changes recommended.

Section 1. No changes recommended.

Section 2. Section 2 is general, and should be included in the list of sections designated as general.

Line 9, strike out words "title of the" so as to read "covered by the sections enumerated."

Section 3, line 6, change to read—

> Clear height measured from the water surface to the lowest part of the superstructure in any span.

Line 10, change to read—

> Measured at right angles to the faces of the piers at the elevation of low water.

Line 15, change to read—

> Of which fixed spans over navigable channels are high enough to permit the passage of boats under them at all stages of water.

Moved for adoption by Major Handbury; seconded by Major Mackenzie. Carried.

Line 17, change to read—

> Having an opening or openings through which boats can pass at all stages of water.

Moved for adoption by Major Mackenzie; seconded by Major Handbury. Carried.

Section 4, line 1, change to read—

> That all low bridges authorized under this act shall be, etc.

The following telegram was received at 1 p. m.:

DUBUQUE, IOWA, *January* 17, 1888.

River interest protest against low-bridge clause, section fourteen, Senate bill two hundred and seventy-five. It means low bridge near Saint Louis.

J. H. STOUT.

Major A. MACKENZIE,
(Care Major Miller,)
U. S. Engineer.

An identical telegram was received by Major Miller.

At this point discussion of section 4 involved discussion of section 20, and of a substitute for section 20, suggested by Major Mackenzie.

The following letter was received and laid before the Board by Colonel Suter:

NEW YORK, *January* 14, 1888.

DEAR SIR: I called on the Chief of Engineers yesterday in reference to Senate bill No. 275, introduced by Mr. Vest, December 12, to authorize the construction of bridges across the Missouri, Mississippi, and Illinois rivers; the object of the bill being to provide a general law for these rivers.

I was informed by General Duane that you were chairman of a board which is instructed to examine and report on this bill. There are, in my opinion, several serious defects and some impracticable provisions in the bill, as follows:

Section 3, line 3. High-water mark is here held to mean the local highest water. I think there should be exceptions to this. As an illustration, take the proposed bridge at Alton, Ill., where the high water of 1844 is 4.2 feet above that of 1858, the next highest water. The 1844 water was produced by a conjunction of causes which never has happened before or since, and the Secretary of War very properly approved plans based on the high water of 1858. On the Missouri River, at extreme highest water, should it ever occur again, no boats would be able to navigate the river, and it does not seem just to compel the transportation lines of the country to build their bridges 4 or 5 and perhaps 6 feet higher than is necessary for navigation, or to haul their freight and passengers to this unnecessary height.

Section 4, line 20. There may be many cases where a protection pier 1,000 feet in length would be impracticable and entirely unnecessary.

Section 7, line 3. Are there not many cases likely to occur where *all* of the spans of a high bridge need not be high spans, but where some of them might, without injury to navigation, be deck-spans?

Section 10, line 7. Wherever high water and low water are used together it is impracticable to meet the requirements of the head-room at high water and above low water at the same time. In nearly all cases mentioned in the bill the difference between high and low water does not agree with the provisions given.

Section 13, line 11, and section 14, line 13. The openings prescribed for draw-bridges in these instances are really beyond a practicable limit, if not in construction, certainly in operation. It would be well to ask the author of this bill to show how he proposes to make a clear opening of 400 feet in a draw-bridge.

Section 16, line 8. Sixty feet of clear height above high water for bridges within 8 miles of the Eads bridge at Saint Louis is 10 feet more than there is, practically, at the present bridge, and also at the Merchants' bridge, according to the latter's charter. There seems to be no necessity for this additional height. The two bridges, one built and the other to be built, should determine the clear head-room.

Section 16, line 11. The requirement for a draw or pivot span on the Lower Mississippi is entirely uncalled for, in my opinion, and would entail a very great expense on any company building a bridge, for the reason that spans of from 500 to 600 feet are the economical spans. If draw-spans are built, it brings three piers, and one of them a very large one, near together. The deep foundations required for these piers also increases the expense very largely. I most earnestly hope that you will strike these requirements out of the bill.

Section 20, lines 40 to 50 inclusive. Do you consider that this clause allows the Secretary of War, through the Chief of Engineers, to modify any of the terms and requirements of this bill? If so, we, as bridge engineers, would be perfectly willing to leave the requirements in case to the Secretary of War.

I hope you will consider this subject very carefully, as I have no doubt you will, for there are important transportation interests involved, not only now but in all the future, that have a right to be heard in this matter. I believe that a general law could be enacted which would be much better than the irregular methods of legislation now practiced, and in this connection wish to suggest that a fixed grade line for certain stretches of the Missouri and possibly of the Mississippi River might be determined by the Chief of Engineers which should be the basis for all bridges built in such stretches, and that this grade line should not be the local highest water, but the average of the high waters as shown by the water-marks or by the height of the alluvial banks along each reach.

Yours, very truly,

E. L. CORTHELL.

Col. CHARLES R. SUTER.

Section 4—continued. Line 15, change to read—

Clear channel-way authorized by this act.

Line 16, change to read—

There may be required one or more protection piers of masonry crib-work or piling as may be directed by the Secretary of War.

Line 17, change to read—

Extending from the end or ends of the draw opening or openings.

Line 20, change to read—

One thousand feet or less from the center line of the bridge.

Line 21, change to read—

With ring-bolts, cavils, snubbing posts, or similar accessories and fender planking.

Line 26, change to read—

When a draw opening is near shore that the end of the opening be connected with the shore.

Line 29, change to read—

To the said draw opening.

Line 32, change to read—

The draw openings next shore becomes.

Line 36, change to read—

Then the bridge company shall, by purchase or otherwise, extinguish the right to obstruct the entrance to the draw opening for a distance of at least 700 feet above and 700 feet below the bridge.

Section 5, line 1, change to read—

Draw openings are required.

Further consideration of this section was postponed.

The following telegram was sent at 4 p. m.:

A Board of Engineer Officers is in session at No. 1415 Washington avenue, Saint Louis, to consider a general law for bridges over the Lower Mississippi. If your body desires to be heard on this subject the Board request early attendance. Answer how soon you can be expected.

SUTER, *Engineers.*

PRESIDENT COAL EXCHANGE,
Pittsburgh, Pa.

Adjourned at 4.15 p. m. to meet at 10 a. m. to-morrow.

SAINT LOUIS, MO., *January* 18, 1888.

Board met at 10 a. m., pursuant to adjournment. Present all the members and the recorder.

Minutes of last meeting were read and approved.

The following letters were laid before the Board by Major Mackenzie:

EAGLE PACKET COMPANY,
Alton, Ill., January 16, 1888.

DEAR SIR: Your favor of the 13th to hand and noted. Replying will say, we consider your suggestions very good, and nothing more than just. You will, no doubt, suggest that good and sufficient approaches be required.

For your many courtesies you have our thanks.

Truly and very respectfully,

G. W. HILL.

Maj. A. MACKENZIE, U. S. A.

[Huse & Loomis Ice and Transportation Company.]

SAINT LOUIS, *January* 14, 1888.

DEAR SIR: Yours 13th just at hand. We thank you for thus giving us the opportunity of expressing our views upon the bridge question.

We think there can be little doubt that no low bridges ought to be allowed over the shifting channel of the Mississippi below the mouth Missouri River. That question was pretty well settled two years ago, and the report by the Board of United States Engineers, yourself, and others, if we remember correctly, was full, and covered the whole matter thoroughly.

We will always probably have the cheaper low bridges over the Mississippi above mouth Missouri; but we think the bridges to be built as new ones and to replace old ones worn out should be erected with more care and with more regard to the interest of navigation than in the past. We think any bridges to be built in future between mouth Missouri River to mouth Illinois River should be of wider span and better protections than those higher up Mississippi. As the Illinois is a great feeder to Mississippi, the current is stronger below than above it, and the volume of business also increased. Hence we think bridges over this portion of the Mississippi should have draws 30 to 40 feet wider than those above it. Being free from bridges at present, this can be done.

In our opinion no bridges over the Mississippi at any point should have draws less than 200 to 225 feet clear space for steamers to pass, and between mouth Missouri, Illinois, not less than 250 feet. The advancement in bridge building makes these spans perfectly easy to bridge builders. And another point seems to us quite as important to the navigation interest as the width of the spans. All bridges should have a long protection of spiling and timber reaching at least 300 to 400 feet above the pivot or center pier of the draw, constructed straight with the current and planked or timbered smoothly, so barges and steam-boats could drop through in windy weather without injury by ragged bolts, etc. The main object of this protection would be for tow and raft boats, in approaching the draw in windy weather, have something to back up against and take out lines to snub through safely. Good snubbing posts should be placed in end of this pier or protection. Such a protection as this would decrease the danger to tow and raft boats as well as passenger steamers, as many windy days they have to lay up, fearing to try to enter a narrow span draw out in the river where there is no place to run a line to steady them. With such a protection tow-boats could drop in carefully against the protection, take out a line and drop through safely, when without it they would be in danger of missing the draw and be drawn under the low superstructure. Each side of the draws such a protection would be comparatively inexpensive to the railroad or bridge company, costing probably $8,000 to $10,000, and act as a rest for their draw and ice-breaker also. They usually erect short ones, say 100 to 150 feet long; but these are so short there is not room for a tow, often 300 to 400 feet long, to get any assistance from them, as more than half the weight of the tow would overlap these short protections and the tow likely to double around them in trying to use them as a guide or to drop through by. These protections are not needed at the lower side, as an up-stream tow failing to enter the draw can drop back and make the second or third effort without danger, which can not be done with the down-stream tow, tow boats usually taking more than they are able to back up out of a draw if they make any mistake in entering. All reasonable security to life and property should be given, and a little additional cost or expense should not be an excuse for neglecting necessary measures. Each bridge erected is an additional tax and expense to all steam-boat navigation. Hence, the corporation or company erecting these obstructions to navigation should make them as safe as possible, even at an additional expense to make them so. Bridges are necessary to the commerce of the country, and must be built to meet that need; but more care is necessary than has been used in the past to see the bridges are as little of an obstruction as possible, and still be economical.

Yours, very truly,

HUSE & LOOMIS ICE AND TRANSPORTATION COMPANY,
WM. L. HUSE,
President.

A. MACKENZIE,
Major United States Engineers.

The following telegram was sent at 10.25 a. m.:

Your telegrams of 17th to Majors Mackenzie and Miller were received and laid before the Board.

SUTER,
Engineers.

J. H. STOUT,
Dubuque, Iowa.

The following letter was sent:

SAINT LOUIS, *January* 18, 1888.

DEAR SIR: Your letter of January 14 was received and laid before the Board.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers.

E. L. CORTHELL, C. E.,
35 *Wall Street, New York.*

The following letters were sent:

SAINT LOUIS, MO., *January* 18, 1888.

SIR: I have the honor to inform you that there is now a Board of Engineer Officers in session at 1415 Washington avenue, which has under consideration a general bridge law covering the Mississippi River below the Eads bridge.

The Board would be glad to hear your views on the subject.

They will be in session to-day and to-morrow from 10 a. m. to 4 p. m.

If you are not able to attend in person, the Board would like to receive a table giving the lengths, the breadths over all, the heights to top of pilot-house, and the heights to top of chimneys of all of your company's largest steamers.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.

MR. JOHN A. SCUDDER,
President Saint Louis and New Orleans Anchor Line.

SAINT LOUIS, MO., *January* 18, 1888.

SIR: I have the honor to inform you that there is now a Board of Engineer Officers in session at 1415 Washington avenue, which has under consideration a general bridge law covering the Mississippi River below the Eads bridge.

The Board would be glad to have your views on the subject.

They will be in session to-day and to-morrow, from 10 a. m. to 4 p. m.

If you are not able to attend in person, the Board would like to receive a table giving the lengths, the breadths over all, the heights to top of pilot-house, and the heights to top of chimneys of all of your company's largest steamers; and also the lengths and breadths of your largest tows, including tow-boat, with diagram showing arrangement of tow.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.

Mr. HENRY C. HAARSTICK,
President Saint Louis and Mississippi
Valley Transportation Company.

Consideration of Senate bill 275 was resumed.

The following resolution was adopted:

Resolved, That in lieu of the words "rivers between its mouth and La Salle," in the title of the bill, the following be substituted, "Illinois and Des Plaines rivers, between the mouth of the Illinois and the city of Joliet."

The following resolution was adopted:

Resolved, That in the opinion of the Board the following be substituted for section 1:

That any persons or corporation having lawful authority may hereafter erect bridges at points where said construction will not materially affect the interests of navigation across the Missouri, the Illinois, the Des Plaines and the Mississippi rivers, between the points above mentioned for railroads or other uses, upon compliance with the provisions and requirements of this act; and hereafter no bridges shall be built within said limits, except under the said provisions and requirements.

The following was adopted:

Resolved, That the following be added to Senate bill 275:

That any permission granted by the Secretary of War, under the provisions of this act, for the construction of a bridge, shall be null and void if said construction be not actually commenced within one year and completed within two years from the date of said permission.

Section 6 of Senate bill 275 was then discussed.

The following was adopted:

Line 1, change to read—

That all draw-spans authorized.

Section 7, line 1, changed to read—

That in all high bridges authorized by this act, except as hereafter provided in section —, all spans covering, etc.

Line 3, stop at words "high spans."

Line 4, omit.

Section 8, lines 1 and 2, change to read—

That all piers shall be built parallel with, etc.

Lines 5, 6, 7, change to read—

Imperfect foundations, which will lessen the required water-way, will not be permitted.

Section 9, consideration postponed.

Section 19, strike out, "substance to be made a special section for Upper Mississippi."

Section 20, omit, and substitute a section offered by Major Mackenzie.

Section 21, line 7, change to read—

Conspicuous place on or near all high bridges the clear head-room.

Line 9, change to read—

This height to be readily visible to the naked eye from any point in the channel of the river for a stretch, etc.

Line 13, add—

Bridge, and that on all low bridges there shall be displayed at points plainly visible to boats passing through the draw a record showing the stage of water or whether the river is rising or falling.

Section 22, line 1, change to read—

Constructed, maintained, and managed under.

Section 23, no change.
Section 24, line 3, change to read—

Construct safe and suitable passage-ways.

Section 25, line 3, change to read—

Act so as to preserve free and convenient navigation.

Line 5, omit all after word "expense" and insert following as a new section:

SEC. 26. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require the entire removal of any bridge constructed under the provisions of this act, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it, is also expressly reserved.

At 3 p. m. the following telegram was received:

PITTSBURGH, PA., 18—.

We will send a representative. What day should he get there? Answer quick.

R. BARROWS,
Secretary Coal Exchange.

Lieut. Col. C. R. SUTER.

The following answer was returned. Telegram:

Board will be in session the remainder of the week. Come as soon as possible.

SUTER,
Engineers.

R. BARROWS,
Secretary Coal Exchange, Pittsburgh, Pa.

At 3.30 p. m. Mr. Samuel Brown, of Pittsburgh, appeared before the Board. He is engaged in the coal business.

Clear head-room of 53 feet above high water would be sufficient for his business. Width of span is their pressing necessity. Flanking width of fleet is 700 feet; length of single boats is 170 feet. At Henderson the bridge gives 500 feet width of span. At present have to double trip at Henderson. Lose one day; costs, $250.

Need wider spans on Mississippi below Cairo, because have to flank under bridges, unless they double trip at great expense.

Length of fleet 680 feet by 200 feet for length of tow-boat. Total, 880 feet.

This for a tow of four lengths. Ought to have 700 feet; 800 feet would suit better, and no question of practicability of 800 feet span. They flank by Memphis as they used to; straighten out into Tennessee chute, about at foot, by Fort Pickering.

Mr. Brown left at 4 p. m.

Adjourned at 4.30 p. m. to meet at 10 a. m. to-morrow.

SAINT LOUIS, *January* 19, 1888.

Board met, pursuant to adjournment, at 10 a. m. Present, all the members and the recorder.

Capt. James Good, superintendent, and Mr. Henry C. Haarstick, president of the Saint Louis and Mississippi Valley Transportation Company, appeared before the Board. They submitted the table and diagrams called for in the letters written to them yesterday, as follows:

SAINT LOUIS, *January* 19, 1888.

DEAR SIR: I have your favor of 19th instant asking information concerning our boats, barges, size of tows, etc.

	Feet.
Our barges (largest):	
Length	235
Width	41
Our boats (largest):	
Length, including wheel	260
Width	46
Height top of pilot house	52
Height top of chimneys	75
Tow of seven barges (as per diagram), length, including boat hitched up	660
Width	205

Very respectfully,

HENRY C. HAARSTICK,
President.

Lieut. Col. CHAS. R. SUTER,
Corps of Engineers, U. S. A.

Mr. Haarstick said they do not take full tow—Saint Louis to Cairo—at low water, but send two tow-boats at extra expense, then double up at Cairo, and send one tow-boat below Cairo.

If channel were improved could send full tow from Saint Louis at low water.

Mr. I. M. Mason, superintendent of the Anchor Line, came in at 10.15.

General discussion followed of the conditions of towing on the Mississippi River below the mouth of the Missouri, and of the necessary requirements of bridges in order not seriously to harass navigation.

Mr. Haarstick says his barges stand about 15 feet out of water and run all the year, and so are subject to all kinds of weather, especially wind.

In the Ohio the coal-boats are very low in the water, and run only three to five months in the year. Says the diagram submitted is of a full tow, the size below Cairo. Says his barges cost about $14,000.

On the Ohio few of the boats are brought back.

Valley line took down one tow in 1887 of a total length of 900 feet, including tow-boat.

Captain Good says boils and cross currents cause very careful handling, especially when complicated with wind, which is very troublesome between Saint Louis and Cairo. When a bridge is added, the problem becomes almost always really dangerous to the safety of the tow.

Span should be next the shore the fleet is floating along. Eight hundred feet span would probably be sufficient.

Boils in Louisiana bend break fastenings of fleet; 3-inch lines.

Twenty-two or twenty-three revolutions cut down to nine.

Think will have to lay up, and always run the bridge proposed at Grand Tower, Ill., in the day-time.

Think minimum span between Saint Louis and Cairo should be 650 feet; nothing less than 750 feet below the mouth of the Ohio.

Anchor and Valley transportation lines have already to carry their own navigation insurance; hence bridge obstruction is a very serious detriment.

Should have at least two spans below Cairo.

Captain Mason says to be necessary at Memphis three spans—one 750 feet, two 600 feet, and head-room 85 feet; at Grand Tower three spans—one 750 feet, two 600 feet.

Captain Mason says for Anchor Line highest pilot-house 65 feet, chimney 92 feet.

These gentlemen left at 11.45 a. m. The minutes of yesterday's meeting were then read and approved.

A copy of Senate bill 275 rewritten, with all the changes previously adopted by the Board, was then laid before Board.

Discussion of the bill was resumed.

The following, introduced by Major Mackenzie, was adopted:

Resolved, That in the title of the bill the words "port of Saint Paul" be omitted, and the words "mouth of the Minnesota River" be substituted.

The following was introduced by Colonel Suter:

Moved that this Board represent to the Engineer Department the desirability of establishing uniform high-water grade lines for the various rivers mentioned in Senate bill number 275, and recommend to the department that orders to that effect be issued to its officers, and that the same course be recommended to the Mississippi and Missouri River Commissions, in order that some uniform standard line may be determined from which heights of bridges authorized under this act shall be measured.

Adopted.

The following telegram was received at 1 p. m.:

PITTSBURGH, PA., *January* 19, 1888.

Capt. John S. Dravo, our representative, starts to Saint Louis to-night.

PITTSBURGH COAL EXCHANGE.

Lieut. Col. CHAS. R. SUTER.

The following was introduced by Colonel Suter:

Moved that the special sections of Senate bill number 275 be considered by committees of this Board, composed of the members most familiar with the streams to which the sections pertain, and that these committees report to the full Board their recommendations and the reasons therefor. The committees to be appointed by the presiding officer.

Adopted.

Majors Mackenzie and Handbury were appointed to take the Mississippi above the mouth of the Missouri and the Illinois Rivers—sections 12, 13, 18.

Colonel Suter and Major Mackenzie, to take the Missouri River—sections 10, 11. Colonel Suter and Major Miller, to take the Mississippi River below the mouth of the Missouri River—sections 14, 15, 16, 17.

The Board then continued its work by committees as above named.

At 2 p. m. Capt. Charles S. Rogers, of the Naples Packet Company, called on Major Handbury with regard to Illinois River traffic, and was referred to the subcommittee on that river.

Board adjourned at 4.30 p. m. to meet at 10 a. m. to-morow.

SAINT LOUIS, *January* 20, 1888.

Board met pursuant to adjournment at 10.45 a. m. Present all the members and the recorder.

The minutes of yesterday's meeting were read, slight alterations were made, and they were then adopted.

The following was offered by Major Mackenzie:

Resolved, That in section 1 line 4, after the word "may," the words be added "when public necessity so demands."

Seconded for adoption by Major Handbury. Carried.

The following letter was received:

SAINT LOUIS, MO., *January* 19, 1888.

DEAR SIR: Below please find the height in detail of an Anchor Line steamer:

	Feet.
From the water-line of hull to main deck	6
From main deck to boiler deck	16
From boiler deck to top of sky-light roof	16
From sky-light roof to top of texas	9
From top of texas to top of pilot-house	18
From top of pilot-house in line of the chimneys to top of chimneys	27
Total	92

Yours, truly,

ISAAC M. MASON,
Superintendent.

Lieut. Col. C. R. SUTER,
Corps of Engineers, U. S. A.

The following was introduced by Colonel Suter and adopted:

Resolved, In the case of all bridges built under the provisions of this act, the approaches to the bridge shall be so designed and constructed as not to interfere with the free discharge of the river in seasons of flood, and any encroachment on the high-water cross-section by solid embankments or otherwise, which will result in unduly accelerating the high-water current at the site of the bridge, shall not be allowed.

The following substitute for section 9 was offered by Major Mackenzie and adopted:

SEC. 9. That any persons or company constructing any bridge under authority of this act shall build and maintain at all times, as accessory works to such bridge, such booms, piers, dikes, guard fences, and similar devices as may be necessary to insure at all times a permanent channel for a sufficient distance above and below the bridge site, and for the guiding of rafts, steam-boats, and all other water craft safely under or through said bridge. And if at any time after the construction of the bridge and its accessory works the approaches to draw-openings, channel-spans, or raft passages in bridges over the navigable waters referred to in this act, are found to be dangerous or difficult of access by any important class of river traffic, the Secretary of War may, upon the recommendation of the Chief of Engineers, United States Army, order the parties owning or controlling said bridge to construct and maintain such additional sheer-booms, dikes, and other devices as will obviate the difficulty mentioned, which additional sheer-booms, dikes, and other devices shall be built and maintained at their own expense by the parties owning, controlling, or operating said bridge.

Consideration of Senate bill 275 was then resumed by committees.

The committee on sections 12, 13, and 18 at 11.40 reported as follows:

The committee appointed to consider sections 12, 13, and 18 of Senate bill 275, Fiftieth Congress, first session, have the honor to report as follows:

Sections 12 and 13 refer to bridges over the navigable portions of the Mississippi River above the mouth of the Missouri, and section 18 to bridges over the Illinois River.

The provisions of the bill as presented for the consideration of the committee are—

That on the river above Keokuk high bridges shall have channel spans giving 300 feet clear channel-way and 50 feet head-room; for low bridges, draw openings have 200 feet clear channel-way, and fixed spans having channel-way of 300 feet and head-room of 10 feet at high water. Below Keokuk high bridges to have channel spans of 350 feet, with head-room of 80 feet over low water and 50 feet above high water; low bridges having draw openings giving 300 feet clear channel-way, and the fixed spans shall be 350 feet, and clear head-room shall not be less than 10 feet at high water. For the Illinois River high bridges give channel spans of 300 feet and height of 50 feet; low bridges give openings of 160 feet.

Ponton bridges with openings of 400 feet are also provided for the Upper Mississippi and Illinois Rivers.

The business of the Upper Mississippi River above Keokuk is essentially of the same character as below, and the accommodations required in the two sections are about the same. The rafting traffic requires the greatest space for handling, and some rafts start from above Lake Pepin, within 30 miles of Saint Paul.

For the purpose of reducing the cost of transportation the size of rafts has been increased, and many rafts are now moved down the river from its upper limits 600 feet long and nearly 300 feet wide.

Raft or channel spans in high or low bridges having 350 feet waterway are needed for passing such a raft. The draw openings in low bridges, which low bridges are as a rule the class in use on this portion of the Mississippi, are used by passenger and freight boats and all tows except rafts, and in some cases it is more convenient to use such draw openings for the passage of rafts (the rafts being split) than the fixed channel spans. For large tows and half rafts a width of 200 feet is required for safe and convenient navigation.

Many of the bridges over the Upper Mississippi are low bridges, having draw openings of 160 feet and raft span of 250 feet. In a few cases of bridges built under authority of Congress the openings are less, and in some cases they are greater. Notably at Louisiana, Mo., where two draw openings of 200 feet each are given. The dimensions 160 feet and 250 feet were fixed many years ago. A necessary change in the system of river transportation makes these dimensions now inadequate, and advances in the science of bridge-building makes it as proper to require openings of 200 feet and 350 feet as it was to give the earlier dimensions when they were fixed upon.

The height proposed in the bill as printed for high bridges is 50 feet. But the high bridges now existing over the Upper Mississippi River all of them give a height of over 55 feet, and this height will permit the passage of all steamers now in use on the Upper Mississippi and of steamers best adapted to the Upper Mississippi trade at all stages, provided their chimneys be lowered at extreme high water. This height of 55 feet, while it is not as great as might be desired, will be acceptable by the river interests of the Upper Mississippi as a compromise. All bridges are obstructions to navigation, and each bridge adds its quota to the expense of transportation, attending delays, and difficulties of passage through it. Bridges with inadequate spans and openings cause more trouble, delay, and expense to navigation than bridges with proper-sized spans and openings. The dimensions of existing bridges over the Upper Mississippi (excepting height of high bridges) should not be taken as a guide in establishing the dimensions to be preserved in future bills.

The conditions on the Illinois are similar to those on the Upper Mississippi, and the business which is to be handled on the Illinois (in its future improved condition) is, excepting rafts, the same as the business of the Upper Mississippi, and requirements as to bridges should be about the same, with the exception that on the Illinois, there being no raft interest to accommodate, draw-openings, it is thought, need not exceed 160 feet as provided for in the bill.

In the opinion of the committee the conditions required for bridges over the Upper Mississippi at various points above the mouth of the Missouri being the same, and those for bridges on the Illinois being essentially the same as on Upper Mississippi, and with the idea that it is advisable to simplify the bill as much as possible, it is suggested that all the requirements for the Upper Mississippi and the Illinois be combined in one section. For the reasons given, the committee recommend the omission of sections 12, 13, and 18, and the substitution of the present section as appended.

The present project for the improvement of the Illinois River, which the United States and the State of Illinois are now carrying into execution, contemplates the accommodation of steam-boats of the same class as those navigating the upper Mississippi and Missouri rivers.

A. MACKENZIE,
Major of Engineers.
THOS. H. HANDBURY,
Major of Engineers.

SEC. 12. That all high bridges over the Mississippi River above the mouth of the Missouri, and over the Illinois and Des Plaines rivers, authorized by this act, shall have one or more channel-spans, each having not less than 350 feet clear channel-way and not less than 55 feet clear head-room at high water.

That all low bridges over the same shall have two or more draw openings, each having not less than 200 feet clear channel-way, and in addition to said draw openings, all said low bridges shall have one or more fixed channel-spans, each having not less than 350 feet clear channel way; and every part of the superstructure of said low bridges shall give a clear head-room of not less than 10 feet at high water: *Provided,* That all spans of both the high and low bridges shall be so located as to afford the greatest possible accommodation to the river traffic: *Provided also,* That in case of a low bridge, if the physical characteristics of the locality so require and the interests of navigation be not injured thereby, the lengths of the fixed spans or the number of draw openings may be reduced: *Provided also,* That if the interests of navigation so require, the clear channel ways of any bridge located in the immediate vicinity of an existing bridge legalized by an act of Congress may be made to correspond in length and location of spans to the clear channel-spans of said existing bridge: *Provided also*, That for any two adjacent draw openings of 200 feet each, one draw opening of 300 feet may be substituted, if the interests of navigation be not injured thereby: *Provided further*, That in low bridges over the Illinois and Des Plaines rivers, two or more draw openings of not less than 160 feet each may be permitted: *Provided further*, That on the Mississippi River above the mouth of the Missouri and on the Illinois and Des Plaines rivers, all bridges may be constructed as pile and ponton bridges similar to the ponton railway bridge at Prairie du Chien, Wis., legalized by act of Congress approved June 6, 1874, and such bridges shall be provided with a ponton draw giving not less than 400 feet clear channel way for each navigable channel of the river, and such other openings for the passage of rafts and logs as in the opinion of the Secretary of War may be necessary: *And provided further*, That pile and ponton bridges shall be subject to all the restrictions of this act as regards plans, location, and accessories as provided for in case of high and low bridges so far as they are applicable to such kind of bridges.

Moved by Colonel Suter that this report be accepted and the recommendations adopted. Seconded by Major Miller. Carried.

The committee on sections 14, 15, 16, 17 then reported as follows:

The committee appointed by resolution of the Board of January 19, 1888, to report on sections 14, 15, 16, 17, of Senate bill 275, have the honor to submit the following:

Strike out section 14 and substitute therefor the following:

SEC. 14. That all bridges over the Mississippi River between the mouth of the Missouri River and a point 8 miles above the Eads bridge over the Mississippi River at Saint Louis, Mo., shall be high bridges, with unbroken and continuous spans having at least one channel-span of not less than 500 feet clear water-way; all other spans to have a clear water-way of not less than 400 feet; all spans to have a clear head-room of not less than 55 feet at high water.

The committee is governed by the following considerations in recommending the change suggested:

Low bridges are considered inadmissible below the mouth of the Missouri River on account of the intolerable delay, danger, and difficulty of passage offered and liabilities of change in the position of the channel.

Channel-spans of 500 feet are suggested as affording ample and necessary facility for the passage of the large rafts which come down the river. Other spans of 400 feet are recommended as required to afford ample water-way for the flood water of the river and fair facility for passing through such spans, if desired, at high water. A clear head-room of 55 feet is recommended as giving sufficient room to allow the passage of all boats now navigating this or the river above, or that can now pass under the Eads bridge.

The committee also recommend that for section 15 the following be substituted:

SEC. 15. That all bridges over the Mississippi River, between the Eads bridge over said river at Saint Louis, Mo., and a point 8 miles above said bridge, shall be high bridges, with unbroken and continuous spans, and shall have channel-spans of not less than 500 feet clear water-way over that portion of the river-bed included between the harbor wharf lines as now established or as may hereafter be established by proper authority; all spans over the remaining portion of the present river-bed to have a clear water-way of not less than 300 feet, and the clear head-room under all spans shall not be less than 55 feet above high-water mark.

Your committee is constrained to this action by the same considerations as above mentioned, and in addition by a desire to so plan the bridges which may be constructed in the harbor of Saint Louis as to afford the least obstruction to harbor traffic, and to conform to such harbor lines as are now or may be hereafter established.

Your committee recommend for section 16 the following substitute:

SEC. 16. That all bridges over the Mississippi River between the Eads bridge at Saint Louis, Mo., and the mouth of the Ohio River shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than 700 feet clear water-way; all other spans to have a clear water-way of not less than 500 feet. All spans to have a clear head-room of not less than 70 feet at high water.

The changes recommended are judged desirable for the following reasons:

The length of a full or high-water tow of the Mississippi Valley Transportation Company is 660 feet, and in navigating such a tow down stream it is absolutely necessary to flank or work obliquely to the current. These tows are also subject to much trouble on account of wind, exposing as they do a very large surface, about 15 feet above water, to its influence. For these reasons it would be a very exceptional case when one of these tows could pass through the channel-spans in a normal direction. On the contrary an oblique passage would generally be made. The committee are therefore of the opinion that a channel-span of 700 feet is the least that should be allowed for the convenience of such traffic. The other spans are made at least 500 feet for convenience of navigation and for the passage of floods of high water.

The draw-spans are omitted as entirely unnecessary in a high bridge; a clear head-room of 70 feet being considered ample to allow the passage of all boats now navigating, or likely in the future to navigate, this portion of the river if they lower their chimneys, ample room being thus allowed for height of pilot-house.

For section 17 substitute as follows:

SEC. 17. That all bridges constructed over the Mississippi River between the mouth of the Ohio River and Natchez, Miss., shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than 800 feet clear water-way, all other spans to have a clear water-way of not less than 600 feet. All spans to have a clear head-room of not less than 70 feet at high water.

The considerations which lead the committee to recommend these dimensions are the same as for changes deemed advisable in the last section. In this part of the river the large coal-tows from Pittsburgh are 880 feet in length and create a necessity for a corresponding increase in width of channel-span. This increase is not made in the same proportion as above because these coal-tows, being very low in the water, are not so liable to be affected by wind.

CHAS. R. SUTER,
Lieut. Col. of Engineers, U. S. A.
A. M. MILLER,
Major of Engineers, U. S. A.

SAINT LOUIS, *January* 20, 1888.

The report was accepted. Colonel Suter moved the adoption of sections 14 and 15 as amended by committee. Carried.

Colonel Suter moved adoption of section 16 as amended by committee. Seconded by Major Miller.

Discussion followed.

Last motion withdrawn by Colonel Suter. The following was moved by Major Miller:

Resolved, That in the opinion of the Board, draw openings in bridges between the Eads Bridge at Saint Louis, Mo., and the mouth of the Ohio River are not admissible.

Seconded by Colonel Suter.

Major Handbury moved to amend Major Miller's resolution above by adding the words at the end of the resolution, "under any circumstances."

Seconded by Major Mackenzie.

Amendment carried—3 ayes to 1 no. Vote on resolution as amended—resolution lost by tie vote.

The following was moved by Major Mackenzie:

Resolved, That in the opinion of the Board steamers can not safely pass through draw openings of practicable width in bridges over the Mississippi River below the Eads Bridge.

Seconded by Colonel Suter. Carried unanimously.

Moved by Colonel Suter that the substitute for section 16 be adopted, leaving out of consideration for the present the last clause.

Seconded by Major Miller. Carried unanimously.

Colonel Suter moved that the remainder of the substitute for section 16 be adopted.

Seconded by Major Miller.

Major Miller moved to amend the clause above referred to by substituting 65 feet for 70 feet.

Accepted by Colonel Suter.

Discussion followed.

Amended motion carried—3 to 1.

Major Miller moved the adoption of the substitute for section 17.

Seconded by Colonel Suter. Carried—3 to 1, Major Handbury voting in the negative. See minutes of January 30, 1888.

Major Miller moved that section 5 of Senate bill 275 be omitted in the recommendations of the Board.

Seconded by Colonel Suter. Carried.

Adjourned at 4.30 p. m. to meet at 10 a. m. to-morrow.

SAINT LOUIS., MO., *January* 21, 1888.

Board met at 10.20 a. m., pursuant to adjournment. Present, all the members and the recorder.

Mr. John F. Dravo, representing the Pittsburgh Coal Exchange, then came before the Board to describe their necessities in the matter of bridges over the Mississippi River. He gave his reasons to show that the Lower Mississippi is absolutely needed for transportation of coal fleets in order to supply the Mississippi Valley with coal; says the railroads can not supply the demand.

Asks a channel-way of 1,000 feet; says 800 feet is absolutely the least they can get along with.

Mr. Dravo laid before the Board two diagrams of coal tows, one a tow of the steamer *Jos. B. Williams:*

Total length of tow, including tow-boat and her wheel	feet..	1,032
Total width	do ..	256
Total number of pieces in the tow		39
Cargo	bushels..	821,640

The other tow was of the steamer *W. W. O'Neill*, May 17, 1886:

Total length, including tow-boat and her wheel	feet..	904
Total width	do ..	310
Total number of pieces in tow		41
Total cargo	bushels..	764,546

The diagrams are herewith.

The sizes of tows have largely increased since 1882. He wants bridge-piers to be located by Government engineers. Mr. Dravo also submitted a table of heights of pilot-houses and chimneys of coal tow-boats; also left a newspaper cutting, hereto appended. He left at 11.10 a. m.

[E. W. MacDonald, coal gauger; office 155 Third avenue, residence No. 523 West Chestnut street.]

——— bushels.

LOUISVILLE, KY., *March* 19, 1887.

Measurement of Pittsburgh coal for Grand Lake Coal Company and others.

Thirty boats and four barges lump coal and one barge nut coal No. ——, per steamer *Jos. B. Williams* to New Orleans.

Contains ——— bushels.

——— ———,
City Measurer.

			Bushels.
Staits	Boat, Grand Lake	1,053 C.	15,761
M. & P. C. G	do	1,174 "	23,312
T. J. W	do	1,192 "	25,072
J. D. Risher	do	1,193 "	25,290
Do	do	1,195 "	25,893
W. C. Co	do	1,215 "	24,251
M. & P. G. C. Co	do	1,217 "	25,017
W. N. R. & Co	do	1,218 "	25,004
Horne & R	do	1,219 "	24,420
W. N. R. & Co	do	1,220 "	24,662
J. D. R	do	1,224 "	23,601
Do	do	1,225 "	23,480
Do	do	1,226 "	24,652
Do	do	1,227 "	24,667
M. & P. G. C. Co	do	1,231 "	24,952

			Bushels.	
W. N. R	Boat, Grand Lake	1,232 C.	24,776	
M. & P. C	do	1,233 "	24,846	
W. N. R.	do	1,234 "	25,392	
Staits	Barge, Grand Lake	501 "	13,386	
Do	do	502 "	12,614	
Do	Barge, Grand Lake (wood)	945 "	11,480	
Do	do	1,052 "	9,927	
Do	Barge nut, Grand Lake S. & W.	23 "	11,953	
				494,498
For Horner & Roberts	Boat, Horner and Roberts, H. & R. pit measure.	894 "	23,045	
Do	do	900 "	24,006	
Do	do	901 "	24,202	
Do	do	906 "	24,745	
Do	do	916 "	24,003	
Do	do	921 "	23,099	
Do	do	922 "	23,128	
				167,128
For O'Neill & Co	Boat, O'Neill & Co	130 "	24,121	
Do	do	182 "	23,856	
Do	do	251 "	24,012	
Do	do	256 "	24,057	
Do	do	267 "	23,508	
				119,554
				781,180
Fuel:				
Barge nut and T. D. R.		8 "	12,882	
Boat nut slack, Grand Lake		1,001 "	9,570	
Sided flat nut, Grand Lake		1,157 "	6,010	
Coaled out of barge lump coal, Grand Lake		1,028 "	11,998	
				40,460
				821,640

[Newspaper cutting.]

THURSDAY, *January* 19, 1888.

Lake Erie Discrimination.—Report of the Commission favors the Railroad Company.

The official report of the decision of the interstate Commerce Commission in the case of Riddle, Dean and Company *vs.* the Pittsburgh and Lake Erie Railroad Company, deciding some very important and interesting points, and in favor of the railroad company, has just been published. Both shippers and railroad men have been awaiting the report with anxiety. The coal company complained first that the Lake Erie Railroad, in violation of section 3 of the act to regulate commerce, was guilty of giving unlawful preference to other coal miners along the Pittsburgh, McKeesport and Youghiogheny Railroad, by refusing to furnish their proportion of cars daily to the Rainbow Coal Company and the Lake Shore Gas Coal Company, for shipments of coal to Buffalo, N. Y.; second by giving unlawful preference to the coke trade; and third in failing to compel the various mills and furnaces located along its line to unload ore, limestone, and iron promptly from its cars, but allowed them to stand loaded for days at a time on their sidings, and thereby gave an unlawful preference in this matter to the undue and reasonable prejudice and disadvantage of the Rainbow Coal and the Lake Shore Gas Coal Company, and other mines represented by complainants.

The commission finds that the Lake Erie, operating the Pittsburgh, McKeesport and Youghiogheny, is an independent line with close running arrangements and the exchange of business between the Atlantic and Great Western Railroad Company and the Lake Shore and Michigan Southern Railroad Company. These arrangements providing for the exchange of business do not contain any provision that is in conflict with the right of the connecting company to give directions as to the traffic in the handling of which their cars shall be used, when furnished by either of them to the Pittsburgh and Lake Erie Railroad Company, to be loaded and returned to points on their respective lines. The bulk of the equipment of the Pittsburgh and Lake Erie is used for its local business between New Haven and Youngstown.

At the time when this complaint was made, as stated in the opinion, there was a "car famine," and the road could only furnish about one-half the number of cars required for the transportation of coal and coke. There was a blockade at Buffalo, and cars carrying coal to that market were detained on the sidings there from ten days to two weeks. In consequence of this orders were issued by the connecting lines of the Lake Erie road against having any of their cars loaded for Buffalo, the object being to keep their cars at home along their own line in transporting coal and coke to Ashtabula and Cleveland. The evidence does not show that any other persons applied to the company for coal cars to Buffalo during this period, although it does show that the company refused to allow coal cars to go there for any shipper during this period on account of the reasons assigned.

In conclusion the Commissioners say that they are unable to perceive by what construction the evidence could be held to sustain the charge of "unlawful preference." The Pittsburgh and Lake Erie Railroad Company was not permitting any of its cars to go to Buffalo for reasons which were sufficient. The report continues: "It is in no way in conflict with either the spirit or the letter of any of the provisions of the act to regulate commerce. These reasons were that on account of causes, for which it was in no way responsible, and for which in no way it could be justly blamed, the company then had more work than it could possibly do in transporting freights over its own line, and if it had permitted its coal cars to go to Buffalo with coal for these two mines it would have thereby rendered itself less able to serve all the business over its line. The company had its legal duty to perform. Its first and most paramount legal duty to the shipping public was to make its entire freight equipment do its utmost in serving the shippers along its own line."

Dimensions and heights of Ohio River coal tow-boats.

Steamers.	Length.	Breadth.	Height to top of pilot-house.	Height to top of chimneys.
	Feet.	*Feet.*	*Feet.*	*Feet.*
W. W. O'Neill	245	52	50	80
Jos. B. Williams	252	52.6	52	86
John A. Wood	237	48	48	78
Boaz	235	45	54	84
Raymond Horner	235	45	52	82
Smoky City	195	42.4	48	78
John F. Walton				
Harry Brown	250	52	55	85
Fred Wilson	200	35	46	
Dick Fulton	200	35	45	
Dan Kaine				
Jim Wood	198	37	44	
S. L. Wood	228	42	50	80
Iron Age				
Ironsides				
Anna Roberts	175	35	42	
Nellie Spear	175	32	36	
Jos. Warne	149	26	28	
Tom Reese, No. 2	198	36	42	
B. D. Wood	153	27	27	
Grand Lake	198	37	44	
Alice Brown	238	48	50	80
Charley Brown	240	46	45	
Sam Brown	188	39	45	
Alex Swift	190	38	45	

The minutes of yesterday's meeting were then read, amended, and approved.

Major Mackenzie moved the following change in Senate bill No. 275:

Section 4, line 13 (19 pencil corrected copy), after "water" add "and said draw opening shall be visible from all parts of the channel for a distance of not less than 1 mile above said opening; and wherever practicable, and in the interests of navigation, all bridges located in the vicinity of important landings shall be placed above rather than below said landings."

Seconded by Major Miller. Carried.

Moved by Major Mackenzie that in—

Section 12, line 18 (pencil copy), there be added after the word "traffic" the words "and a draw opening of low bridges shall, if practicable, be located next or near one shore." Section 12, line 7 (pencil copy), after word "water" add "and the clear headroom under other than channel-spans may be less than 55 feet, provided that no part of such superstructure shall give a less head-room than 10 feet at high water, and that the interests of navigation be not injured by such reduction in height of said fixed spans."

Seconded by Major Miller. Carried.

Moved by Major Mackenzie that in—

Section 4, line 20 (pencil copy), there be added after the words "channel-spans" the words "or draw-openings," and in section 4, line 22 (pencil copy), after the word "required" the words "as a part of the necessary accessory works provided for in this act," and in section 4, line 40 (pencil copy), to omit the word "require" and substitute "also require as a part of said necessary accessory works."

Adopted.

The following change was moved by Major Mackenzie:

Section 4, line 8 (pencil copy), omit "and provided with such sheer-booms. guard-fences, or other structures."

Adopted.

The following change was moved by Major Mackenzie:

Section 20, line 55 (pencil copy), after the word "reports," add the words "that the bridge is not a public necessity or;" and add at the end of section 20, "that whenever the Secretary of War has good reason to believe that any of the provisions of sections 8, 9, and 25 of this act have not been complied with by any persons or company owning, controlling, or operating a bridge authorized under the provisions of said act, it shall be the duty of the Secretary, on satisfactory proof thereof, to require the said persons or company to comply with the provisions of said sections, and on failure of said persons or company to comply with the said requirements within a reasonable time, the Secretary of War shall proceed to cause the necessary work required by law, in the form of additions, alterations, repairs, or removal of obstructions to be made at the expense of the United States, and shall refer the matter without delay to the Attorney-General of the United States, whose duty it shall be to institute, in the name of United States, proceedings in any circuit court of the United States, in which such bridge, or any part thereof, is located, for the recovery of the cost thereof, and all moneys accruing from such proceedings shall be covered into the Treasury of the United States:

"*Provided*, That, in the construction of additional accessory works not contemplated by the approved plan of bridge and accessory works, no greater sum than fifteen thousand dollars shall be required to be expended upon any one bridge in a single year:

"*Provided further*, That such sum of money as may be necessary to execute the provisions of this section is hereby appropriated out of any money in the Treasury of the United States not otherwise appropriated, to be paid on the requisition of the Secretary of War."

Adopted.

The following change was moved by Major Mackenzie:

Section 20, line 25 (pencil copy), for "one mile" substitute "three miles."

Adopted.

The following was moved by Major Handbury:

Resolved, That for section 7 of the pencil copy of Senate bill 275 before the Board the following be substituted:

"SEC. 7. That in all high bridges authorized by this act, except as hereinafter provided (Sec. 12), every span over the water-way between the shore-lines of the river at high water shall give a clear head-room not less than that prescribed for those over channel-ways; also that in such high bridges one or more wide or channel-spans, of lengths to be hereinafter prescribed, shall be placed over the main channel or channels of the river; and in case the channel is variable the number of channel-spans shall be increased so that there may be a good navigable passage for all classes of boats under some part of the bridge at all stages of water."

Adopted.

At the request of Majors Mackenzie and Handbury, and in order to enable them to obtain further information upon matters before the Board which in their opinion is essential to a proper conclusion of its labors, the Board, at 1 p. m., adjourned to meet at 10 a. m. on Friday, January 27, 1888.

SAINT LOUIS, MO., *January* 27, 1888.

Board met at 10 a. m., pursuant to adjournment. Minutes of last meeting were read and approved.

The following letter was laid before the Board:

PITTSBURGH, PA., *January* 24, 1888.

MY DEAR SIR: In answer to your inquiry as to the effect of large tows of coal on the cost of transportation, after dilligent search I beg to submit as follows:

During the war, when the towing system was in process of development and steam-tugs had not the capacity as now, 10 and sometimes 15 cents per bushel were paid for towing from Louisville to points below Cairo. After the war, when commercial and trade prices had assumed normal values, the price settled at about 6 cents from Louisville to points below.

The history and experience of the Grand Lake Coal Company will furnish the most satisfactory answer to your inquiry. I received from the officers of the company the following statement:

Commencing some time after the close of the war the steamer *Grand Lake*, with a towing capacity of ten boats, received 5 cents per bushel for towing from Louisville to New Orleans and intermediate points. The *Grand Lake* was succeeded by the *Grand Lake* No. 2, with a towing capacity of sixteen boats. Owing to the decline in transportation prices, the company sold No. 2, and built the present *J. B. Williams*, with a present known capacity of thirty boats and eight barges, and are now towing coal with some profit from Louisville to New Orleans at 2 cents per bushel.

It is claimed by parties in the trade that if the river is not injured by artificial obstructions steamers will be constructed in the near future with a towing capacity of fifty boats, carrying 1,000,000 and over of bushels of coal. Our people claim that any channel-span at Memphis less than 1,000 feet will endanger the passage of large tows, as the river at that point has to be "flanked;" the tow, instead of being in a straight line, has to be placed almost at right angles with the river channel, and would have to pass sidewise—the steamer and tow.

If the "gauge measure" of the *Williams* tow has not been mailed to me, please do so, as the paper is just now needed by the company.

Yours, very truly,

JOHN F. DRAVO.

Colonel SUTER.

The following report of the Mississippi River Commission on a proposed bridge at Memphis was then read:

[Extract from the proceedings of the Mississippi River Commission at its session of May 9 to 14, 1884.]

General Comstock, from the special committee on Memphis bridge, submitted as a report the draught of a letter, as follows:

MISSISSIPPI RIVER COMMISSION,
ON BOARD STEAMER MISSISSIPPI,
New Orleans, La., May 14, 1884.

The CHIEF OF ENGINEERS, U. S. ARMY:

SIR: I have the honor to return herewith House bill No. 2799, and the other papers relating to a bridge across the Mississippi River at Memphis, Tenn., sent me with your indorsement of February 13, 1884, and to submit the views of the Mississippi River Commission, which has duly considered the subject, in reference to such a bridge.

The Commission has corresponded with the chambers of commerce at Pittsburgh and Cincinnati; with the president of the Saint Louis and New Orleans Anchor Line, and the Saint Louis and Mississippi Valley Transportation Company, and has obtained information from Maj. A. M. Miller, United States Engineer, who has observed the method followed by tows in passing Memphis.

Major Miller states that large tows are 775 feet long by 192 feet wide.

P. Follansbee, of the Pittsburgh Chamber of Commerce, states that on February 27, 1884, the steamer *W. W. O'Neil* left Louisville with a tow of 38 pieces, carrying 700,294 bushels of coal, the length of the tow, including steamer, being 900 feet and its width 265 feet.

When such a tow meets a bend in the river the steamer begins backing, to pull the upper end of the tow and the tow itself away from the concave bank. This operation is called flanking. In this way, in passing bends, the axis of the tow becomes inclined to the axis of the river, and in cases of sharp bends or swift currents may be at right angles to it, as seen in sketch by Major Miller, submitted herewith. That sketch shows tows which passed Memphis going down the east side of President's Island.

Major Miller states to the Commission that tows also pass down the west side of President's Island, and in that case, instead of taking a position when below the custom-house such that their axes are parallel to the current, as in the sketch, they may have to retain an oblique position in passing nearly the whole of the Memphis front. It must be remembered that the channel on the west side of President's Island is the main channel, is the one which requires the most flanking, and that in the progress of the improvement of the river it may be advisable to close the other.

In consequence of this necessity for tows when following the main river to flank along nearly the whole of the Memphis front, the place is, so far as the interests of navigation are concerned, an objectionable one for a bridge.

The United States is expending large sums in improving the river, and should permit no one to place a serious obstacle to navigation in it.

In view of the facts stated and of the possible increase in the size of tows, the Commission is of opinion that, if a bridge is permitted at Memphis, it should have at least one channel span with a clear opening at right angles to the current of 1,000 feet, and that the lowest part of this span should be 75 feet above extreme high water. There is now being built in Great Britain a Cantelever bridge, with spans exceeding 1,700 feet, for a railroad.

The report was adopted.

A true extract.

SMITH S. LEACH,
Captain of Engineers,
Secretary Mississippi River Commission.

The following letter was laid before the Board:

JEFFERSONVILLE, IND., *January* 24, 1883.

Maj. A. MACKENZIE,
Saint Louis, Mo.:

DEAR SIR: Your letter of the 21st duly to hand. The bridge question is one that has bothered the river men for several years, and it will be a hard matter to get up a law that will suit them. The channel of the Mississippi is so changeable that it will be almost impossible to bridge it without interfering with the navigation. As the bridges are sure to come, the question to build them so that they will interfere as little as possible with the navigation of the streams which they cross is the vital question to be considered. The cross-currents and the great change in the channel in high and low water is the real question to consider. If the current or channel always run in one place there would be no trouble whatever. The best-posted steamboat men say that all spans should be long or channel spans, so a boat could go through any of the spans in all stages of the water, and if there is a draw it should be near or next to the shore, as they would never use it only in extreme high water. The coal men want room in width, and they are not so particular as to height, and they say the spans should not be less than 600 feet for safety in passing through.

Some of the coal tows that go south are from 900 to 1,200 feet long and from 200 to 250 feet wide; so you can see that when caught in a cross current they are hard to manage and want all the room they can get. So you can see why the coal and barge men cry for side room and the packets for head-room.

Some of the Anchor Line boats when light are 64 feet from the water to the top of the pilot-house. I think this can be lowered some 8 or 10 feet without any serious inconvenience to the boats. I think they are a little over the average height of river boats, although some of the cotton boats in the South are still higher. However, I think the Anchor Line boats are the extreme, and if you go by them you can't miss it much, and any law based on their size would give general satisfaction.

Advocate all the room that you can both ways consistently with the safety of the structure. The more room that you can give the better it will be for navigation.

I hope this little information will be of some use to you, and I am at all times at your service for all I can do or know.

I have been quite busy in the yard for the last year, and I expect to put in marine ways this coming summer. Do you expect to build any boats for your department this season?

With regards to all and best wishes for your success, I am,
Respectfully, yours,

ED. J. HOWARD.

The following were laid before the Board:

SAINT LOUIS, MO., *January* 26, 1888.

A. H. BLAISDELL, Esq.,
Assistant Engineer.

THE WYOMING.

	Feet.
Height to top of pilot-house	54
Height to top of chimneys	63
Dimensions:	
Length of boat	265
Beam	45

DACOTAH.

Height to top of pilot-house	48
Height to top of chimneys	57
Length of boat	252
Beam	50

Respectfully, yours,

JENKINS & SASS.

[Copy of resolutions adopted at River Convention, Dubuque, Iowa, January 17 and 18, 1888.]

"One hundred and thirty-three delegates present, representing the States of Minnesota, Iowa, Wisconsin, Illinois, and Missouri.

"We heartily indorse Senate bill 275, excepting the low-bridge clause in section 14, after the word act, in line 8, against the adoption of which we strongly protest, for reasons that a bridge so constructed in accordance with this clause would prove a most serious obstruction to navigation.

"The proposition to construct such a bridge has already been condemned by a Board of United States Engineers especially appointed by the Secretary of War to examine and report upon the advisability of allowing the construction of a low bridge between the mouth of the Missouri River and the Eads bridge, at Saint Louis, Mo.

"The adoption of this clause would be in effect putting condemned special legislation in a general bill.

"We further and respectfully urge that a section substantially as follows be added to Senate bill 275: That no charter or permit shall be granted for the building of a second bridge in the vicinity of one already in operation until it has been shown to the satisfaction of the Secretary of War that the bridge already constructed is inadequate for the demands of traffic."

Saint Louis and New Orleans Anchor Line—Table showing certain dimensions.

Name of boat.	Length over all.	Width over all.	Height of pilot-house.	Height of chimneys.	Runs between Saint Louis and—
	Feet.	*Feet.*	*Feet.*	*Feet.*	
City of Saint Louis	800	85	65	92	New Orleans.
City of New Orleans	800	84	62	90	Do.
City of Baton Rouge	800	84	62	90	Do.
Will S. Hays	295	80	60	88	Do.
Arkansas City	278	78	59	88	Vicksburg.
City of Vicksburg	283	78	58	88	Do.
City of Providence	283	78	58	88	Do.
City of Monroe	281	78	58	88	New Orleans.
City of Cairo	281	78	58	87	Vicksburg.
Belle of Memphis	281	78	57	89	Do.
Crystal City	234	76	56	85	Cape Girardeau.

Saint Louis and Mississippi Valley Transportation Company—Table showing certain dimensions.

Name of tow-boat.	Length over all.	Width over all.	Height of pilot-house.	Height of chimneys
	Feet.	*Feet.*	*Feet.*	*Feet.*
Henry Laurey	245	46	52	70
Oakland	245	46	52	74
Port Eads	240	44	52	74
Future City	225	46	52	75
Jay Gould	225	40	52	74
John Gillmore	220	44	52	70
My Choice	220	44	47	70
Sidney Dillon	205	44	40	60
E. M. Norton	204	40	38	60

The following copy of Senate bill 275, as recommended to be changed by the Board, was then taken up for consideration.

The following changes were adopted:

Section 1, line 8, for "Railroads" put "Railroad." Line 6, instead of "across the," etc., substitute "across the Missouri River between its mouth and the mouth of the Dakota or James River, and across the Mississippi River between the mouth of the Minnesota River and Natchez, Miss; and across the Illinois and Des Plaines rivers between the mouth of the Illinois and the city of Joliet, in the State of Illinois, for railroad or other uses," etc. Line 10, after "built" insert "over said rivers."

Section 2, line 9, "to such points," to "at such points."

Section 3, line 12, after "piers" insert "measured on the center line of the bridge." Line 14, strike out "fixed," substitute "the." Line 3, "local highest water" to "local high-water, medium stage or lowest water-level at the bridge site as determined by the Secretary of War." Line 18, erase "may or."

A BILL to authorize the construction of bridges across the Missouri River between its mouth and the mouth of the Dakota or James River and across the Mississippi River between the mouth of the Minnesota River in the State of Minnesota, and the port of Natchez in the State of Mississippi, and across the Illinois and Des Plaines rivers between the mouth of the Illinois and the city of Joliet in the State of Illinois, and to prescribe the character, location and dimensions of the same.

SECTION 1. *Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled*, That any persons or corporations, having lawful authority, may hereafter, when public necessity so demands, erect bridges at points where said construction will not materially affect the interests of navigation across the Mississippi, Missouri, Illinois, and Des Plaines rivers, between the points above mentioned for railroads or other uses upon compliance with the provisions and requirements of this act, and hereafter no bridges shall be built within said limits except under the said provisions and requirements.

SEC. 2. That the sections of this act numbered
shall be general and shall apply to all bridges authorized under this law; and that the sections numbered
shall apply specifically to bridges to such points on the Mississippi, Missouri, Illinois, and Des Plaines rivers as are covered by the sections enumerated.

SEC. 3. That wherever the phrases "high water mark," "medium stage of water," or "low-water mark" are used in this act they shall be held to mean the local highest water, medium stage, or lowest water-level at the bridge site; and wherever the phrase "clear head-room" is used it shall be held to mean the clear height measured from the water surface to the lowest part of the superstructure in any span; and wherever the phrase "clear channel-way" is used it shall be held to mean the clear width of openings measured at right angles to the faces of the piers at the elevation of low water; and wherever the phrase "length of span" is used it shall be held to mean the distance between centers of adjacent piers; and wherever the phrase "high bridge" is used it shall be held to mean a bridge of which fixed spans over navigable channels are high enough to permit the passage of boats under them at all stages of water; and the phrase "low bridge" shall be held to mean a bridge having an opening or openings through which boats may or can pass at all stages of water.

SEC. 4. That all low bridges authorized under this act shall be so located that a good channel can be kept and maintained for the passage of boats at all navigable stages of water; and that the said channel shall be made easily accessible by boats at all such stages; and that the draw or pivot spans shall be located over the above-specified channel in such a manner that one or both of the openings can be conveniently and safely reached by boats at all navigable stages of water; and that one opening at least of a draw or pivot span shall be over the best and most convenient channel of the river, for all classes of river traffic, at any stage of water; "and said draw-opening shall be visible from all parts of the channel for a distance of not less than one mile above said opening; and, wherever practicable and in the interests of navigation all bridges located in the vicinity of important landings shall be placed above rather than below said landings;" and that in all bridges with channel-spans or draw-openings of less than three hundred feet clear channel-way authorized by this act, there may be required as a part of the necessary accessory works provided for in this act one or more protection-piers of masonry, crib-work, or piling as may be directed by the Secretary of War, extending from the end or ends of the draw-opening or openings, or one of the rest-piers of the draw or pivot span, as may be directed by the Secretary of War, up-stream for a distance of one thousand feet or less from the center line of the bridge and which protection-pier shall be properly arranged with ring-bolts, cavils, snubbing-posts, or similar accessories and fender-planking so as to enable boats to tie up alongside of it and drop down through the draw-openings at such times as it may be dangerous to attempt the passage of the draw when under headway; and in addition to the protection-pier, the Secretary of War may also require as a part of said accessory works when a draw-opening is near shore that the end of the opening be connected with the shore by a substantial guard-fence, extending up-stream in such direction and to such distance as will render access to the said draw-opening easy and safe at all times; and also that if, by reason of the location of a bridge in or near a city harbor, or from any other cause, the draw-opening next shore becomes difficult of access at any season or seasons because of the proximity of river craft which are or may be tied up to the bank, or from any other cause, then the bridge company shall by purchase or otherwise extinguish the right to obstruct the entrance to the draw-opening for a distance of at least seven hundred feet above and seven hundred feet below the bridge.

SEC. 6. That all draw-spans authorized by this act shall be operated by steam or other reliable mechanical power, and shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over said span or spans; but in no case shall unnecessary delay occur in opening said draw after the passage of trains; and also, that in case the opening of a draw is delayed by reason of the passing of a train after the signal has been given from a boat ready to pass through, the draw shall be opened for the passage of such boat before another train is allowed to pass over the said bridge; nor shall there be any unnecessary delay in the passage of trains over the bridge or of boats through said draw.

SEC. 7. That in all high bridges authorized by this act, except as hereinafter provided (section 12), every span over the water-way between the shore lines of the river at high water shall give a clear head-room not less than that prescribed for those over the channel-ways; also, that in such high bridges one or more wide, or channel-spans of lengths to be hereinafter prescribed, shall be placed over the main channel or channels of the river; and in case the channel is variable the number of channel-spans shall be increased so that there may be a good navigable passage for all classes of boats under some part of the bridge at all stages of water.

SEC. 8. That all piers shall be built parallel with the current of the river at that stage of water which is most important for navigation; and that riprapping or other protection for imperfect foundations which will lessen the required water-way will not be permitted; also, that piers which will produce cross-currents or bars dangerous to navigation shall not be constructed; and if after construction any piers or protection walls are found to produce the above-mentioned effects, or if any riprapping or other protection prohibited by this section is found to exist, the nuisance shall be abated or corrected by or at the expense of the parties owning, controlling, or operating said bridge.

SEC. 9. That any persons or company constructing any bridge under authority of this act shall build and maintain at all times, as accessory works to such bridge, such booms, piers, dikes, guard-fences, and similar devices as may be necessary to insure at all times a permanent channel for a sufficient distance above and below the bridge site; and for the guiding of rafts, steam-boats, and other water-craft safely under or through said bridge; and if at any time after the construction of the bridge and its accessory works the approaches to draw openings, channel-spans, or raft passages in bridges over the navigable waters referred to in this act are found to be dangerous or difficult of access by any important class of river traffic, the Secretary of War may, upon the recommendation of the Chief of Engineers, United States Army, order the parties owning or controlling said bridge to construct and maintain such additional sheer-booms, dikes, and other devices as will obviate the difficulty mentioned; which additional sheer-booms, dikes, and other devices shall be built and maintained at their own expense by the parties owning, controlling, or operating said bridge.

SEC. 12. That all high bridges over the Mississippi River above the mouth of the Missouri and over the Illinois and Des Plaines rivers authorized by this act shall have one or more channel-spans, each having not less than three hundred and fifty feet clear channel-way, and not less than fifty-five feet clear head-room at high water, "and the clear head-room under other than channel-spans may be less than fifty-five feet, provided that no part of such superstructure shall give a less head-room than ten feet at high water and that the interests of navigation be not injured by such reduction in height of said fixed spans;" that all low bridges over the same shall have two or more draw-openings, each having not less than two hundred feet clear channel-way; and in addition to said draw-openings all said low bridges shall have one or more fixed channel-spans, each having not less than three hundred and fifty feet clear channel-way; and every part of the superstructure of said low bridges shall give a clear head-room of not less than ten feet at high water: *Provided*, That all spans of both high and low bridges shall be so located as to afford the greatest possible accommodation to the river traffic, and a draw opening of low bridges shall, if practicable, be located next or near shore: *Provided also*, That in case of a low bridge, if the physical characteristics of the locality so require and the interests of navigation be not injured thereby, the length of the fixed spans or the number of draw openings may be reduced: *And provided also*, That if the interests of navigation so require the clear channel-ways of any bridge located in the immediate vicinity of an existing bridge legalized by an act of Congress may be made to correspond in length and location of spans to the clear channel-spans of said existing bridge: *Provided also*, That for any two adjacent draw openings of two hundred feet each, one draw opening of three hundred feet may be substituted, if the interests of navigation be not injured thereby: *Provided further*, That in low bridges over the Illinois and Des Plaines rivers two or more draw openings of not less than one hundred and sixty feet each may be permitted: *Provided further*, That on the Mississippi River above the mouth of the Missouri and on the Illinois and Des Plaines rivers, bridges may be constructed as pile and ponton bridges similar to the ponton railway bridge at Prairie du Chien, Wisconsin, legalized by act of Congress approved June sixth, eighteen hundred and seventy-four; and such bridges shall be provided with a ponton draw giving not less than four hundred feet clear channel-way for each navigable channel of the river and such other openings for the passage of rafts and logs as in the opinion of the Secretary of War may be necessary: *And provided further*, That pile and ponton bridges shall be subject to all the restrictions of this act as regards plans, location, and accessories as provided for in case of high or low bridges so far as they are applicable to such kind of bridge.

SEC. 14. That all bridges over the Mississippi River between the mouth of the Missouri River and a point eight miles above the Eads bridge over the Mississippi River at Saint Louis, Missouri, shall be high bridges with unbroken and continuous spans having at least one channel-span of not less than five hundred feet clear water-way, all other spans to have a clear water-way of not less than four hundred feet, all spans to have a clear head-room of not less than fifty-five feet at high water.

SEC. 15. That all bridges over the Mississippi River between the Eads bridge over said river at Saint Louis, Missouri, and a point eight miles above said bridge, shall be high bridges with unbroken and continuous spans, and shall have four channel-spans of not less than five hundred feet clear water-way counting from the Missouri shore; all spans over the remaining portion of the present river-bed to have a clear water-way of not less than three hundred feet and the clear head-room under all spans shall be not less than fifty-five feet above high-water mark.

SEC. 16. That all bridges over the Mississippi River between the Eads bridge at Saint Louis, Missouri, and the mouth of the Ohio River shall be high bridges with unbroken and continuous spans having at least one channel-span of not less than seven hundred feet clear water-way, all other spans to have a clear water-way of not less than five hundred feet, all spans to have a clear head-room of not less than sixty-five feet at high water.

SEC. 17. That all bridges constructed over the Mississippi River between the mouth of the Ohio River and Natchez, Mississippi, shall be high bridges with unbroken and continuous spans having at least one channel-span of not less than eight hundred feet clear water-way, all other spans to have a clear water-way of not less than six hundred feet, all spans to have a clear head-room of not less than seventy feet at high water.

SEC. 20. That any authorized person, company, or corporation intending to construct a bridge under the provisions of this act shall give notice for two weeks of such intention, with the kind of bridge and exact location, by publication in papers having a wide circulation in the cities of Saint Louis, Saint Joseph, and Kansas City, in the State of Missouri, Atchison and Leavenworth, Kansas, and Omaha, in Nebraska, concerning bridges to be built over the Missouri River; and in newspapers published and having a wide circulation in the cities of Saint Louis, Missouri, Quincy and Peoria, Illinois, Keokuk, Davenport, and Dubuque, Iowa, La Crosse, Wisconsin, and Saint Paul, Minnesota, for bridges over the Mississippi River above Saint Louis, or Illinois and Des Plaines rivers; and in newspapers published and having a wide circulation in Pittsburgh, Cincinnati, Louisville, Saint Louis, Memphis, and New Orleans, for bridges over the Mississippi River below Saint Louis, and shall submit to the Secretary of War, for his examination, a design and drawings of the bridge, piers, and approaches, and a map of the location, giving, for the space of at least three miles above and one mile below the proposed location, the topography of the banks of the river, and the shore lines at high and low water. This map shall be accompanied by others, drawn on the scale of one inch to two hundred feet, giving for a space of one-half a mile above the line of the proposed bridge, and a quarter of a mile below, an accurate representation of the bottom of the river, by contour lines two feet apart, determined by accurate soundings, and also showing over the whole width of this part of the river the force and direction of the currents at low water, at high water, and at least one intermediate stage, by triangulated observations on suitable floats. The maps shall also show the locations of other bridges in the vicinity, and shall give such other information as the Secretary of War may require for a full and satisfactory understanding of the subject. Said maps and drawings shall be referred to a Board of officers of the Corps of Engineers United States Army for examination and report, which Board shall personally examine the site of the proposed bridge and shall hold a public session at some convenient point to hear all objections thereto, of which public session due notice and invitation to be present shall be given to all interested parties by advertising, and such parties shall be given sufficient time for a full examination and consideration of plans; and if said Board of Engineers reports that the bridge is not a public necessity, or that the location selected is unsuitable for any bridge, or the plans presented are unfavorable to the interests of navigation for a bridge at the site proposed, the Secretary of War is authorized, on recommendation of said Board, to refuse permission for construction of a bridge on the proposed location, or to order such changes in the bridge or its piers, or such dikes, booms, piers, or other structures, as may be necessary for confining the flow of water to a permanent channel for a distance of not less than one mile above the bridge-site and a proper distance below, and for guiding of rafts, steam-boats, and other water craft safely under said bridge or through the draw and raft spans at the expense of the parties constructing such bridge; but in no case shall there be a reduction in the number, widths, or heights of draw, raft, or channel spans, or arrangement and length of accessory works, required by this act, unless such reduction is made necessary by the physical characteristics of the river in the locality where the building is proposed or is shown clearly to be in the interests of navigation; and the proposed bridge shall only be a legal structure when built in accordance with the plans as recommended by the said Board of Engineers and approved by the Secretary of War, and so managed and kept in repair as to offer at all times reasonable and proper means for the passage of rafts, steam-boats, and other water craft through or under said bridge, and only so long as all the requirements of this act are observed; and that whenever the Secretary of War has good reason to believe that any of the provisions of sections 8, 9, and 25 of this act have not been complied with by any persons or company owning, controlling, or operating a bridge authorized under the provisions of this act, it shall be the duty of the Secretary of War, on satisfactory proof thereof, to require the said persons or company to comply with the provisions of said sections, and on failure of said persons or company to comply with said requirements within a reasonable time, the Secretary of War shall proceed to cause the necessary work, required by law, in the form of additions, alterations, repairs, or removal of obstructions to be made at the expense of the United States, and shall refer the matter, without delay, to the Attorney-General of the United States, whose duty it shall be to institute, in the name of the United States, proceedings in any circuit court of the United States in which such bridge, or any part thereof, is located, for the recovery of the cost thereof, and all moneys accruing from such proceedings shall be covered into the Treasury of the United States. *Provided*, That in the construction of additional accessory works not contemplated by the approved plan of bridge and accessory works, no greater sum than fifteen thousand dollars shall be required to be expended upon any one bridge in a single year; and further, that such sum of money as may be necessary to execute the provisions of this section is hereby appropriated out of any money in the Treasury of the United States not otherwise appropriated, to be paid on the requisition of the Secretary of War.

SEC. 21. That all parties owning, controlling, or operating bridges authorized by this act shall maintain at their own expense, from sunset to sunrise, throughout the year and during heavy fogs, such lights on the bridges as may be required by the Light-House Board for the security of navigation; and shall also, during the season of navigation, have posted in a conspicuous place on or near all high bridges the clear head-room under the channel-span on that day, the figures expressing this height to be readily visible to the naked eye from any point in the channel of the river for a stretch of four thousand feet, of which three thousand feet shall be above and one thousand feet shall be below the channel-span of the bridge; and that on all low bridges there shall be displayed at points plainly visible to boats passing through the draw a record showing the stage of water and whether the river is rising or falling.

SEC. 22. That any bridge constructed, maintained, and managed under this act and according to its limitations shall be a lawful structure and shall be recognized and known as a post route, upon which also no higher charge shall be made for the transportation over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation of said mails, troops, and munitions over the railroads and public highways leading to said bridge; and the United States shall have the right of way for postal telegraph purposes over any such bridge; and in case of any litigation arising from any alleged obstruction to the navigation of any of said rivers created by the construction of any bridge under this act the cause or question arising may be tried before the circuit court of the United States of any State in which any portion of said obstruction or bridge touches.

SEC. 24. That the persons or corporations constructing bridges under the provisions of this act shall have the right to construct safe and suitable passage-ways thereon for foot passengers and vehicles of every description and to charge a reasonable toll therefor; but the rates of toll shall be submitted to the Secretary of War and shall be subject to his approval or to any change he may think proper from time to time in such rates.

SEC. 25. That such alterations and changes as may be required by the Secretary of War or Congress in bridges constructed under the provisions of this act so as to preserve free and convenient navigation shall be made by the persons or corporations owning or controlling said bridges at their own expense.

SEC. 26. That the right to alter, amend, or repeal this act is hereby expressly reserved. And the right to require the entire removal of any bridge constructed under the provisions of this act, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it is also expressly reserved.

SEC. That any permission granted by the Secretary of War under the provisions of this act for the construction of a bridge shall be null and void if said construction be not actually commenced within one year and completed within two years from the date of said permission.

SEC. That in the case of all bridges built under the provisions of this act, the approaches to the bridge shall be so designed and constructed as not to interfere with the free discharge of the river in seasons of flood; and any encroachment on the high-water cross-sections by solid embankments or otherwise, which will result in unduly accelerating the high-water current at the site of the bridge, shall not be allowed.

Line 9, erase all after "openings". Line 10, erase "to the faces of the piers"; after "water" insert "measured at right angles to the direction of the current of the river at that stage of water which is most important to navigation".

Section 4, line 6, erase "or pivot spans", substitute "opening or openings"; line 7, "or both" to "or all"; lines 9 and 10 strike out "of a draw or pivot span"; line 9, insert "draw" before "opening"; line 17, "channel" to "channel or raft spans"; line 23, erase "the draw-opening or" put "such spans or"; line 23, erase "or one"; line 24, erase; line 25, erase to and including "war"; line 27, after "pier" add "or piers"; line 29, erase "of it"; line 30, insert after "openings" "channel or raft spans"; line 29, after "boats," insert "or rafts"; line 31, put "same" for "draw"; line 34, insert after "opening" "or raft-span"; line 35, insert after "opening" "or span"; line 37, insert after "opening" "or raft-span"; line 40, insert after "opening" "channel or raft span"; line 45, for "to the" put "to said draw-opening or span"; line 11, erase "for all classes of river traffic"; line 43, for "bridge company" put "company or persons owning, controlling, or operating said bridge".

Section 6, line 11, for "bridge" put "span or spans"; line 13, erase.

Section 7, line 2, erase "(Section 12)"; line 3, after "river" insert "at a bankful stage"; line 3, erase "at high water".

Section 8, line 3, after "navigation" put "and the bridge itself shall be built as nearly as may be at right angles thereto"; line 8, for "protection walls" put "accessory works"; line 11, insert after "corrected" "under the direction of the Secretary of War".

Section 8, line 12, for "parties" put "company or persons".

Section 9, line 15, put "order the company or persons owning, controlling, or operating said bridge to construct under his direction and to"; line 20, for "the parties" put "said company or persons"; line 21, strike out.

Section 12, line 6, after "head-room" put "above high-water mark"; line 10, same; line 20, same; line 30, insert "proposed" after "any"; line 9, for "such" put "the"; line 9, after "superstructure" add "of such spans"; line 12, erase "of said fixed spans"; line 10, put "and provided further"; line 28, erase, beginning with "and" and extending to and including "bridge" in line 33, to be inserted elsewhere.

Section 14. Major Handbury proposed a substitute for sections 14 and 15, which he read.

Discussion followed.

Section 20, line 4, for "with" put "stating"; line 13, after "Missouri" insert "Chicago"; line 17, after "or" put "over the"; line 55, put "allowed" for "given"; line 59, for "any" put "a"; line 61, omit "for a bridge"; line 65, after "or" put "the construction of"; line 24, after "approaches" put "and accessory works"; line 80, make read "clearly to be not injurious to the interests"; line 75, for "heights" put "head-room"; line 103, omit "required by law"; line 91, make a new section beginning "That whenever," etc.; line 111, after "States" put "of any State in which any portion of said obstruction or bridge touches' '; line 110, for "any" put "the".

Section 21, line 1, for "all parties" put "any companies or persons"; line 17, omit "that"; line 17, put "shall display"; line 17, change to read "and shall display on all low bridges"; line 4, for "year" put "season of navigation" and omit "and during heavy fogs"; line 5, before "on" insert "and other signals".

Section 22, line 2, "managed" make "operated".

Section 24, add at end "and provided that the construction authorized by this section shall not reduce the clear head-room or clear channel-way required by the provisions of this act".

Section 25, line 6, put "shall be made under the direction of the Secretary of War and at their own expense by the company or persons owning, controlling, or operating".

Section 27. Time for completion of bridges changed from two to three years.

Section 28, line 7, after "by" insert "piers".

Major Handbury moved that the following resolution of the Board, adopted January 17, 1888—

> That all former laws or parts of laws authorizing the construction of bridges over the Missouri, Mississippi, or Illinois rivers, in conflict with this act and under the authority of which actual construction has not yet been commenced, are hereby repealed—

be changed to read as follows:

> SEC. 31. That all acts or parts of acts heretofore enacted granting authority for the erection of a bridge or bridges over the navigable waters of the United States contemplated by this act be, and the same are hereby, declared null and void in each and every case in which actual construction of said bridge or bridges be not commenced on or before the date of the passage of this act.

Carried.

The following was offered by Major Mackenzie: A new section to Senate bill 275, as follows:

> SEC. 29. That all bridges constructed under the authority of this act shall be built under the general supervision of the Secretary of War, and no changes or alterations

in plans shall be made during construction of said bridges, or after their completion, unless said changes or alterations conform to the provisions of this act and are authorized by the Secretary of War. That during original construction or in carrying out any authorized changes or repairs of said bridges, a navigable channel shall be preserved at the site of the bridge at all times and the water-way of the river shall not be obstructed to a greater extent than is absolutely necessary, and such lights and buoys shall be kept on all coffer-dams, piles, etc., as may be necessary for the security of navigation.

Carried.

The following was adopted as a new section:

SEC. 30. That if the interest of navigation so require, the clear channel-ways of any proposed bridge located in the immediate vicinity of an existing bridge legalized by an act of Congress, shall be made to correspond in length and location of spans to the clear channel-spans of said existing bridge.

Discussion followed as to the order of sections in the bill as recommended by the Board.

The Board at 4.30 p. m. adjourned to meet at 10 a. m. to-morrow.

SAINT LOUIS, MO., *January* 28, 1888.

Board met at 10.15 a. m. pursuant to adjournment. Present, all the members and the recorder. The minutes of yesterday's meeting were read, amended, and approved.

The following changes of Senate bill No. 275 were adopted:

Section 30, lines 4 and 5, strike out "legalized by act of Congress"; line 5, change "shall" to "may."

Section 31, changed to read—

That all former acts or parts of acts granting authority for the erection of any bridge or bridges over the portions of the rivers set forth in section 1 of this act be, and the same are hereby, repealed in each and every case where actual construction of said bridge or bridges be not commenced on or before the date on which this bill becomes a law.

Moved by Colonel Suter—

That it is expedient to call attention in the report of the Board to the fact that for the Missouri River the provisions of Senate bill 275 apply only as far up as the mouth of the James or Dakota River, and on the Mississippi River only as far down as the port of Natchez. The Board consider that there is no physical feature requiring this limitation. On the Missouri River essentially the same features prevail, so far as navigation is concerned, from the mouth of the Platte to the head of navigation at Fort Benton; and on the Mississippi there is no change of any importance until the mouth of Red River is reached. Below that point some special modifications in the requirements might be needed, but the Board do not consider this likely to be the case until sea-going ships are met with, as at New Orleans.

Adopted.

The Board agreed to reconsider sections 14, 15, 16, 17. Adopted January 20, 1888.

The following changes were moved by Colonel Suter:

Section 14, line 12, change to read "above high-water mark." Line 1, change to read "all bridges authorized by this act"; line 10, change to read "and all said spans shall have"; line 8, change to read "all other spans over the water-way to have a clear channel-way"; line 8, change "water-way" to "channel-way."

The section as amended was adopted.

Section 15, line 1, change to read "bridges authorized by this act"; line 6, omit all of section after word "have," and substitute as follows:

Over that portion of the river-bed embraced between the wharf-line of the city of Saint Louis, as now established, or as may hereafter be established, within the limits specified and a line parallel thereto and 1,500 feet distant therefrom, spans of not less than 500 feet clear channel-way, and having not less than 55 feet clear head-room above high-water mark. The spans over the remaining portion, if any, of the river-bed shall have not less than 300 feet clear channel-way, and may have such reduced head-room as in the opinion of the Board of Engineers, elsewhere provided for in this act, will not be prejudicial to the interest of navigation.

The section as amended was adopted.

Section 16, line 1, change to read "bridges authorized by this act"; line 7, change to read "channel-way"; line 8, change to read "channel-way"; line 7, change to read "all other spans over the water-way"; line 9, change to read "and all said spans shall have"; line 11, change to read "above high-water mark"; line 6, change to read "six hundred and fifty feet."

The section as amended was then adopted, three to one.

Section 17, line 1, change to read "bridges authorized by this act over"; line 7, change to read "channel-way"; line 7, change to read "spans over the water-way"; line 8, change to read "channel-way"; line 9, change to read "feet and all said spans shall have"; line 11, change to read "above high-water mark."

Carried.

At 4.30 p. m. Board adjourned to meet at 10 a. m. Monday.

SAINT LOUIS, MO., *January* 30, 1888.

Board met pursuant to adjournment at 10 a. m. The minutes of last meeting were read and approved.

Committee on sections 10 and 11 appointed January 19, 1888, for bridges over the Missouri River, then at 10.30 a. m. began the duty assigned them. At 12.45 p. m. they reported as follows:

SAINT LOUIS, MO., *January* 30, 1888.

Your committee on sections 10 and 11 of Senate bill 275 beg leave to submit the accompanying draughts of three sections as substitutes for sections 10 and 11 of the bill.

The main features in the substitutes to be noted are that high bridges alone are allowed, and that geographical divisions, having reference to the size and volume of the river, are substituted for the arbitrary division introduced in the bill. The necessity of prohibiting draw-bridges is, in the opinion of your committee, plainly evident to any one conversant with the fierce current and changeable character of the Missouri River. Out of a total of 17 bridges already built or now in process of construction, only four are draw-bridges, and these are all extremely difficult and dangerous of passage at high water, and two at least have been rendered at times impassable at low water by the shifting of the channel from under the draw-spans. The last draw-bridge built was constructed at Atchison in 1874, and since then ten other bridges have been built in which the high type has been used, although their charters authorized draw-bridges, and this is understood to have been mainly on the score of economy in construction. There would seem, therefore, to be no hardship involved in forbidding a type of bridge which is admitted by all to be dangerous and undesirable, and can not even be recommended in most cases on the score of economy. The lengths of spans called for are not excessive, and it is worthy of note, in this connection, that all recent bridges have 400-foot spans over the water-way, although their charters have never called for more than 300 feet. The reason for this is stated to be that the cost of foundation outweighs that of the superstructure. Above the Kaw River the height heretofore called for by all bridge acts, viz, 50 feet, is retained. Below the Kaw River this height is increased to 55 feet, for the reason that high floods recur here more frequently, and, as in the natural order of things, more boats will be likely to ply here than above the Kaw, the detention from insufficient height will be more frequent, more serious, and of longer duration.

CHAS. R. SUTER,
Lieut. Col. of Engineers.
A MACKENZIE,
Major of Engineers.

Sections as recommended by committee:

SEC. 11. That all bridges authorized by this act, over the Missouri River above the mouth of the Platte River shall be high bridges with unbroken and continuous spans, all spans over the water-way to have a clear channel-way of not less than 300 feet, and a clear head-room of not less than 50 feet above high-water mark.

SEC. 12. That all bridges authorized by this act, over the Missouri River below the mouth of the Platte River and above the mouth of the Kaw River, shall be high bridges with unbroken and continuous spans, having at least one channel-span of not less than 400 feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than 300 feet, and all said spans shall have a clear head-room of not less than 50 feet above high-water mark.

SEC. 13. That all bridges authorized by this act, over the Missouri River between its mouth and the mouth of the Kaw River, shall be high bridges with unbroken and continuous spans, all spans over the water-way to have a clear channel-way of not less than 400 feet, and a clear head-room of not less than 55 feet above high-water mark.

Report and sections as recommended were adopted.

Discussion followed as to sequence of sections in amended bill. An order was agreed upon.

At 2.30 p. m. Mr. Henry Flad, M. A. S. C. E., and president Board of Public Works, came before the Board; said "the Saint Louis Harbor line ended at Bissell's Point; limit of 8 miles above Eads bridge does not extend to new city limits; Chain of Rocks, 9 miles from Eads bridge; 7.5 miles from water-works to Chain of Rocks. New city limits comes about one-half to 1 mile above Chain of Rocks."

Moved, by Colonel Suter, that section 15, line 3, be changed to read: "And the northern limits of the city of Saint Louis, Mo."

Carried.

Moved, by Colonel Suter, that section 16, line 3, be changed to read: "And the northern limits of said city shall be," etc.

Carried.

General discussion of practicable length of truss-spans followed. Colonel Flad says, "600-foot truss is about the present limit; above that limit have to use another system, like cantilever." In a cantilever he has no preference between upper and under suspension. Says "upper suspension would probably be cheaper. Settlement would probably not make much different results in cantilever and other kinds of bridges. Fifteen years ago made calculations for arched bridge of 1,500 feet span. Suspension safest for long bridges. Can get guarantees of steel wire of 240,000 pounds per square inch." Says, "for Lower Mississippi thinks spans should be at least 1,500 feet. If he was to build a bridge below mouth of Ohio would make spans as wide as possible."

Wants harbor line for Saint Louis to be established; asks whether United States Engineers can not do it.

At 3.20 p. m. Mr. Flad left.

Moved by Major Handbury:

Resolved, That the words "800 feet" in line 6, section 18,* be changed to read "650 feet."

Seconded by Major Mackenzie.

Vote.—Major Mackenzie, aye; Major Miller, no; Major Handbury, aye; Colonel Suter, no.

Lost.—Tie vote.

Moved by Major Mackenzie that section 18 (final number), line 6, be changed to read "700 feet" instead of "800 feet."

Seconded by Major Handbury.

---

*Final number referred to in previous minutes as section 17.

Vote.—Major Handbury, aye; Major Miller, no; Major Mackenzie, aye; Colonel Suter, no.

Lost.—Tie vote.

Major Handbury moved that section 18 (final number), line 8, be changed to read "5" instead of "6."

Seconded by Major Mackenzie.

Vote.—Major Handbury, aye; Major Miller, no; Major Mackenzie, no; Colonel Suter, no.

Lost.—Three to one.

Major Mackenzie desired to change his vote January 20, 1888, for the adoption of section 17 (section 18 final number).

Colonel Suter moved the adoption of section 18 (final number), as amended January 28, 1888, excepting the words "eight hundred," in line 6.

Seconded by Major Miller.

Vote.—Major Handbury, no; Major Miller, aye; Major Mackenzie, aye; Colonel Suter, aye.

Carried.—Three to one.

Colonel Suter moved the adoption in line 6, section 18 (final number), so as to read "eight hundred feet."

Seconded by Major Miller.

Vote.—Major Handbury, no; Major Miller, aye; Major Mackenzie, no; Colonel Suter, aye.

Lost by tie vote.

The following was moved by Major Miller:

> *Resolved*, That in the opinion of the Board for bridges over the Mississippi River below the mouth of the Ohio, channel-spans of 500 feet and 600 feet, as authorized by Senate bill No. 275, are inadequate.

Seconded by Colonel Suter; carried unanimously.

Moved by Major Miller that Colonel Suter be requested to write the report of the Board.

Seconded by Major Mackenzie; carried three to one.

Board at 4.30 p. m. adjourned without day.

CHAS. R. SUTER,
Lieut. Col. of Engineers,
President of Board.
THEODORE A. BINGHAM,
First Lieut. of Engineers,
Recorder.

W W 2.

BRIDGE ACROSS STATEN ISLAND SOUND, KNOWN AS ARTHUR KILL.

WAR DEPARTMENT,
Washington City, May 11, 1888.

SIR: I have the honor to inclose a letter of the 20th ultimo from the Chief of Engineers, together with two reports from a Board of Engineer Officers, appointed to investigate the alleged obstruction to navigation of the bridge in process of construction across the Arthur Kill, and the necessity of Senate bill No. 1842, Fiftieth Congress, first session, or other legislation relating to said bridge. These reports, being a majority and a minority report, are transmitted in response to the resolution of your committee, dated February 9, 1888.

The majority recommends a span 400 feet long on the Staten Island side, to be connected with the New Jersey shore by a pivot-draw having a total length of 500 feet, the whole to be 50 feet above mean high water. The Board estimates that the cost of the changes proposed by the majority will be $143,000.

The minority recommends that the bridge now being constructed be raised so as to be 50 feet above mean high water. It is stated that this will accommodate 81 per cent. of the water traffic without requiring the draw to be opened, and that the change proposed can be made for $38,000.

If any modification is to be required by Congress in the plans approved by the War Department, under which the bridge is now in process of construction, as directed by the act of June 16, 1886, I concur in the recommendation of the minority report of the Board, which changes the existing plans only in the elevation of the present structure to 50 feet above mean high water.

A supplemental report, giving the approximate cost of changes proposed, is also transmitted, in accordance with your oral request of the 27th ultimo.

Very respectfully,

WILLIAM C. ENDICOTT,
Secretary of War.

Hon. WILLIAM P. FRYE,
Chairman Committee on Commerce, U. S. Senate.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., April 20, 1888.

SIR: I have the honor to return herewith the letter from the Committee on Commerce of the United States Senate, inclosing resolution of the committee and S. 1842, a bill "to amend an act to authorize the construction of a bridge across Staten Island Sound, known as Arthur Kill, and to establish the same as a post-road," and to report that, in compliance with the request of the committee, a Board of Engineers was, with the sanction of the Secretary of War, convened by Special Orders Nos. 8 and 9 from this office, to examine and report upon the bill in question.

The reports of the Board, dated April 10, are herewith submitted, from which it will appear that the members were divided in opinion in regard to the subject, except as to the height of the bridge under consideration, which was agreed by all the members should be 50 *feet above mean high water*, measured to the lowest part of the superstructure.

It will appear that the majority of the Board recommends, in addition to raising the bridge to 50 feet above mean high water, a change in the plan of the draw-span, etc., as shown in the drawing accompanying its report.

The minority considers a sufficient concession is made to the navigation interests by recommending the increased height of the bridge.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

LETTER OF INSTRUCTIONS TO BOARD OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 20, 1888.

SIR: The inclosed communication of the 11th instant from the Committee on Commerce of the United States Senate and accompanying resolution of that committee, and S. 1842, Fiftieth Congress, first session, a bill "to amend an act to authorize the construction of a bridge across Staten Island Sound, known as Arthur Kill, and to establish the same as a post-road," are transmitted for the information and action of the Board of Engineers constituted by Special Orders No. 8, Headquarters Corps of Engineers, current series, of which you are the presiding officer, attention being specially invited to the indorsement of the Secretary of War thereon, dated the 18th instant. The letter of the Chief of Engineers to the Secretary of War upon the subject, dated the 17th instant, is also inclosed.

It is desired that the Board give the subject the careful consideration its importance demands, and that due notice be given to the Staten Island Rapid Transit Railroad Company, to the Baltimore and New York Railroad Company, to the Pennsylvania Company, and, as far as practicable, to all parties interested, as to the time and place appointed for the meeting of the Board, in order that they may be afforded an opportunity for expressing their views in reference to the bill in question.

The Board is authorized to visit the locality of the bridge and to cause such examinations to be made thereof as may be deemed necessary to a proper understanding of the subject.

* * * * * * *

By command of Brigadier-General Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Col. THOS. LINCOLN CASEY,
Corps of Engineers, U. S. A.

REPORT OF BOARD OF ENGINEERS ON S. 1842, A BILL "TO AMEND AN ACT TO AUTHORIZE THE CONSTRUCTION OF A BRIDGE ACROSS STATEN ISLAND SOUND, KNOWN AS ARTHUR KILL, AND TO ESTABLISH THE SAME AS A POST-ROAD."

ARMY BUILDING,
New York City, April 10, 1888.

GENERAL: The Board of Engineers convened by Special Orders Nos. 8 and 9, current series, from the Headquarters Corps of Engineers, was instructed to consider and report upon Senate bill 1842 in conformity with the resolution of the Committee on Commerce of the Senate, which resolution was passed at a meeting of the said committee February 9, 1888, as follows:

> *Resolved,* That the Secretary of War be requested to detail a Board of Engineers for the examination of the Staten Island Bridge, now in process of construction, especially in reference to its alleged obstruction to navigation; to give to the parties in interest a hearing touching the same; and then advise this committee as to the necessity of the accompanying bill (S. 1842) or other legislation.

A hearing was given the parties in interest March 21 at the Board rooms in New York City, and the papers filed (exhibits marked 1 to 25, respectively) are appended to the report. A transcript of the stenographic notes taken at the hearing (marked A) and other papers filed subsequent to the conclusions of the Board as arrived at in this report (marked 26 to 29, respectively) are also appended.

The first part of the duties required of the Board was "the examination of the Staten Island Bridge, now in process of construction, especially in reference to its alleged obstruction to navigation."

The bridge in question, now being constructed across the Arthur Kill by the Staten Island Rapid Transit Company, is located about 2,800 feet below the mouth of Elizabeth River and just above the mouth of Old Place Creek. The width of the stream at this point, measured parallel to the axis of the bridge at mean low water, is 700 feet. The superstructure of the bridge is to be supported by five stone masonry piers, namely, a pivot-pier, placed in the middle of the water-way, and with its oak fenders occupying 50 feet in width; two rest piers to support the ends of the draw, their axes 250 feet from the center of the pivot-pier, and provided with fenders on the channel side; and two abutment piers, their axes 150 feet from the axes of the rest piers. These last piers are located on the banks of the stream. The clear water-way on each side of the pivot-pier at mean low water is 207 feet. The height of the bridge at its lowest point above mean low water is 34.7 feet.

When the Board inspected the bridge, March 31, the pivot-pier was completed, and the crib-work support, for the draw when open, built to about 5 feet above high water. Both the abutment piers had been finished, but neither of the rest piers had been commenced. The caissons were in position, but had not been settled. The bridge is located and is being constructed substantially in accordance with the act of June 16, 1886, but, as will be noted, both the draw-spans and height of superstructure above mean low water are slightly greater than the law requires. The plan of the bridge piers, as they are being constructed, is shown on sheet No. 1, accompanying this report, while upon the same plan are shown the depth of water and set and velocity of the tide through the eastern draw-span upon the first, second, and third quarters of the flood.

From this it will be seen that the direction of the flood current is as nearly parallel to the draw-pier as could be expected in a channel of this width. The observations were made upon the currents at a depth of 6 feet below the surface.

The Arthur Kill, extending from the mouth of the Raritan River to Elizabethport, N. J., is a tidal stream some 12 miles in length, with a navigable depth at mean low water of 13 feet and at high water of 18 feet. In the lower two-thirds of its length it attains at some points a width of 3,500 feet, while on the upper third it narrows to a water-way of from 600 to 800 feet. The commerce of this stream is extensive, reaching an average of 6,000,000 of tons of freight transported annually.

The navigation used upon this stream is mainly that of tows, the boats forming the tows being canal-boats, chunkers, barges with derrick masts, etc., and are generally of a style unsuited to rough water. Sailing vessels, schooners, barks, and oyster vessels, with steamers, tugs, and side-wheel passenger and freight-boats, also make use of this stream in the interest of commerce. It is probable, however, that nine-tenths of the freight carried is transported on the tows. They are made up at South and Perth Amboy from boats that have been loaded at those ports, and from boats that have come down the Raritan River and through the Delaware and Raritan Canal, and in some rare cases have attained the size of seventy-six boats in a tow. Usually the tows consisted of about forty boats. They were arranged in a mass of five boats abreast to eight boats in length, carrying from 6,000 to 7,000 tons of freight. Leaving the mouth of the Arthur Kill upon the first of the flood, with a tug connected by a hawser to the front of the tow, and with frequently a second tug to control the rear of the tow, in passing sharp bends in the channel, the tows would arrive at the site of the bridge in question at from one and one-half to two hours before high water, the object being to pass through the Kill von Kull and reach the waters of New York Bay in time to secure the last of the flood passing up the bay. These tows were unwieldy, and with the motive power supplied could little more than be directed into the thread of the current, and it was in passing sharp bends and narrow channels that they gave the most trouble. In the narrower parts of the Kill they frequently would come in collision with the banks and structures upon them, demolishing whatever was struck by them, and sometimes entailing large claims for damages upon the owners of the tows. Indeed they were considered a nuisance by other classes of boats navigating the stream, but they were evidently, with all their faults, the cheapest mode of carrying the freight through the Kill.

It is now maintained that to pass the bridge in question in safety the tows from the Amboys will have to be reduced in size to four boats abreast by five in depth, making twenty boats in a tow, which tow must be attended by at least as much motive power as attended the larger tow before the bridge was built. It is understood by the Board that there is no opposition to this statement. This condition of things must at least double the cost of towing, and when there are further considered the small height of the bridge above the water, necessitating the draw to be opened for tows, the delays that must at times happen in the opening of the draw, the loss of tide from delays, the collisions with the masonry piers and guard piles of this bridge under the varying conditions of wind, tide, fog, and darkness to which the tows will be exposed, some additional cost must be entailed upon the navigation through the spans of this bridge.

The sailing and large steam-boat interests are well pleased with the form and dimensions of the present bridge. A draw must be opened for them, and as they have only a single vessel to look out for, they can with ease pass through the draw-spans of 200 feet, especially if the strength of the current is setting fair through the span they use.

The Board is of the opinion, after careful consideration of the questions involved, and an "examination of the Staten Island Bridge now in process of construction, especially in reference to its alleged obstruction to navigation," that the said bridge is a serious obstruction to navigation through the Arthur Kill.

The next duty required of the Board is to advise the Committee on Commerce as to the necessity of Senate bill 1842, or other legislation.

Senate bill 1842 is in the following terms:

A BILL to amend an act to authorize the construction of a bridge across Staten Island Sound, known as Arthur Kill, and to establish the same as a post-road.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section two of said act be amended so as to read as follows:

That said bridge shall be constructed so that the channel-face of the east pier thereof shall be on the Staten Island bulkhead or shore-line, and whose channel-span shall give a clear opening of four hundred and fifty feet, and whose span next west shall be a draw-span giving one-hundred and twenty-five feet clear opening; the lowest parts of these spans being fifty feet above mean high water. The foundations of the piers shall be so arranged as to admit future deepening of the Kill to twenty feet: *And provided also,* That said draw shall be opened promptly, upon reasonable signal, except when trains are passing over the said bridge, for the passage of the boats whose construction shall not be such as to admit of their passage under the draw of said bridge when closed; but in no case shall unnecessary delay occur in opening the said draw after the passage of trains; and the said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

Had the bridge in question been built originally in accordance with the project contained in this bill, its most serious interference with the navigation of the Arthur Kill would have been removed, but in view of the progress made upon the construction of the bridge, undertaken and carried on under the terms of the act of June 16, 1886, the Board is of the opinion that a bridge giving great relief to the navigation can yet be constructed and but little of the work already done be lost to the company. Upon Sheet No. 2, accompanying this report, is shown in plan (figure 1) the position of the piers of the bridge now building. Figure 2 represents the position of the piers of a bridge now proposed by the Board, as follows: Let the abutment pier on Staten Island and the center pivot as built remain in their present position. The distance between their centers is 400 feet; they should be connected by continuous trusses, giving a clear water-way of 350 feet after the shore of Staten Island shall have been dredged away to the face of the abutment pier and upon a line parallel with the bulkhead line. Occupy with a new pivot pier the position of the western rest pier, and mount upon this pivot pier the draw, which it is understood is about completed. Place the lowest part of the superstructure at the level of 50 feet above mean high water. By this arrangement the tows will be enabled with much less cost and risk to pass under the bridge and without requiring a draw to be opened, and the masted vessels and large steamers will have at their disposal a draw-span of the present bridge giving a clear water-way of 200 feet.

The Board would recommend that the bill (S. 1842) be amended so as to read as follows:

That said bridge shall be constructed as a pivot draw-bridge, and the piers of said bridge shall be located as follows: Beginning at the eastern end of the bridge on the Staten Island shore the first pier, number one, shall have its axis distant four hundred feet from the center of the water-way, measured along the axis of the bridge.

The next pier west, number two, shall have its axis located at the center of the water-way. The next pier west, number three, shall be a pivot-pier for the draw and shall have its center located two hundred and fifty feet west of the center of number two. The next pier west may be a rest pier for the draw, and may be located two hundred and fifty feet west of the center of number three. The piers shall be built to such a height that the lowest part of the work forming the superstructure of the bridge shall not be less than fifty feet above mean high water, and the foundations of the piers shall be so arranged as to admit future deepening of the Kill to twenty feet. So much of the western shore of Staten Island as lies outside of a line parallel to the bulkhead line and touching the western face of the most eastern pier shall be dredged off for a distance above the axis of the bridge of four hundred and thirty feet and below the bridge of one hundred and twenty-five feet, so as to secure a clear channel-way beneath the eastern span of thirteen feet in depth at mean low water and three hundred and fifty feet in width: *And provided also*, That said draw shall be opened promptly upon reasonable signal, except when trains are passing over the said bridge, for the passage of the boats whose construction shall not be such as to admit of the passage under the draw of said bridge when closed. But in no case shall unnecessary delay occur in opening the said draw after the passage of trains; and the said company or corporation shall maintain at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

THOS. LINCOLN CASEY,
Colonel, Corp of Engineers.
HENRY M. ROBERT,
Lieut. Col. of Engineers.
PETER C. HAINS,
Lieut. Col. of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

MINORITY REPORT.

The undersigned can not agree entirely with the opinion of the majority of the Board, as set forth in the foregoing report, and therefore submit the following:

Inasmuch as this Board owes its existence to the desire on the part of the Senate Committee on Commerce for advice as to the necessity for certain legislation, as set forth in Senate bill 1842, or possibly other legislation; inasmuch as all the papers bearing upon the *history* of this bridge are referred to the Board, and the instructions to the Board are that it should give a hearing to all the parties interested, it is conclusive to our minds that we can not ignore the fact that the bridge now in process of construction was authorized by the act of Congress approved June 16, 1886, and the plans of construction were approved by the War Department after a long and full hearing from both sides, and *after the rejection by the Senate* of a bill identically the same as the one now under consideration; hence we are of the opinion that we must give due consideration to the fact that the Staten Island Rapid Transit Railroad Company proceeded in good faith with the construction of this bridge upon what it could very naturally regard as a final decree or judgment. It has erected piers as authorized, and expended a large amount of money in so doing, and also for shop-work, on the superstructure now nearly completed. In our opinion all this must be considered in arriving at a decision whether or not the bridge, if constructed as authorized, would be an unreasonable obstruction to navigation.

It is conceded by Congress, by Engineers, and by the Courts that *any* structure erected in a navigable water-way is an obstruction, but the Courts have uniformly held that the term obstruction is to be construed as meaning *unreasonable* obstruction. It is believed to be a well-established rule that, in order to determine whether or not a bridge is an unreasonable obstruction, the commerce to be benefited by the bridge and the interests involved therein are to be considered as well as the interests of navigation. "The rights of commerce by vessels, although pre-existing, are not paramount to the rights of commerce by any other way. Some concessions must be made on every side for the convenience and the harmonious pursuit of different occupations." It is in view of this spirit of mutual concession, which must prevail, that it must be held that the bridge should not be simply the cheapest which can be built, but that the company should be content to incur the extra expense of constructing a bridge which shall not prove to be an unreasonable obstruction. On the other hand, the parties interested in the navigation should not ask that the Bridge Company be put to unreasonable expense, and should accept gracefully the fact that the expenses of navigation may be reasonably increased. In the case of the *Mollie Mohler*, it is well stated by the United States Supreme Court that—

> The officers of steamers plying the Western waters must be held to the full measure of responsibility in navigating streams where bridges are built across them. These bridges, supported by piers, of necessity increase the dangers of navigation, and river-men, instead of recognizing them as lawful structures, built in the interest of commerce, seem to regard them as obstructions to it, and apparently act on the belief that frequent accidents will cause their removal. There is no foundation for this belief. Instead of the present bridges being abandoned, more will be constructed.
>
> The changed condition of the country produced by the building of railroads has caused the great inland waters to be spanned by bridges. These bridges are to a certain extent impediments in the way of navigation; but railways are highways of commerce as well as rivers, and would fail of accomplishing one of the main objects for which they were created, the rapid transit of persons and property, if rivers could not be bridged. It is the interest as well as the duty of all persons engaged in business on the water-routes of transportation to conform to this necessity of commerce. If they do this, and recognize railroad bridges as an accomplished fact in the history of the country, there would be less loss of life and property, and fewer complaints of the difficulties of navigation at the places where these bridges are built.

That in adjusting the rights of private parties to the public interests it is clearly the intention of Congress to permit *some* degree of obstruction is evident, and this degree can best be inferred from the kind of obstruction that has been sanctioned by Congress as well as by the executive and judicial departments of the Government.

The suspension bridge between New York and Brooklyn requires all large sailing vessels navigating the East River to send down their topmasts, and although it was shown at the time the structure was under discussion that this would be a considerable expense as well as an inconvenience to navigation, the Courts refused to interfere.

The bridges across the Allegheny and Monongahela rivers at Pittsburgh compel all large steamers to lower their smoke-stacks. This is also required at the Eads bridge at Saint Louis during high stages of the river.

Congress has thus far declined to provide a draw in the new Aqueduct Bridge across the Potomac at Georgetown, although it has been shown that such draw would be a great convenience, if not an absolute necessity, to enable suitable vessels to reach the great stone-quarries above the site of the bridge.

We have been thus particular in reference to the history of the bridge before the Board, to the action of Congress, and to the rulings of the Courts for the reason that we can not conscientiously disregard them in determining what legislation to recommend to the Committee on Commerce.

Will the bridge, if completed on the plans as at present authorized, constitute an unreasonable obstruction? We have no hesitation in answering yes. The lowest member of the superstructure is to be only 34 feet 8 inches above *mean low-water mark.* This would leave a height of less than 30 feet above *high water*, which is the stage at which the tows pass the bridge. This height, in our opinion, is *not sufficient*, and would constitute an unreasonable obstruction.

Do the piers as located and constructed constitute an unreasonable obstruction? In our opinion, no. In view of the history of the bridge it would appear to us to be unreasonable to demand that the Staten Island Rapid Transit Railroad Company should tear out the work already completed and be obliged to incur the extra expense of constructing entirely new piers and superstructure simply because the Pennsylvania and Lehigh Valley Railroad companies may have to incur some extra expense over the cost of the pre-existing methods of navigation. If the navigation companies are to incur *no* expense, then it would seem to us that the doctrine of mutuality of concession is lost sight of.

It seems to us that the question simply is, will the increase of expense in towing to be an *unreasonable one?* It is claimed that the navigation companies will be put to great extra expense, and that consequently the public interests will suffer. We can not conscientiously believe the price of coal in any market of the world will be affected 1 cent by this bridge. We are not satisfied that the navigation companies will have to incur *any* extra expense; but even if they do, we do not believe that such expense will be so great as to be held by any Court to be unreasonable. We do not believe that a greater number of tugs will be required to take any given tow past the bridge than around Corner Stake Light or past Shooters' Island.

The claim that there will be great loss of life and property in passing the bridge we can not consider for a moment; the law requires that competent and skilled captains and pilots shall be employed by transportation companies. We believe that any competent pilot can take any reasonable tow past the bridge in safety. Novelty has ever been a bugbear to conservatism, and it is a well-known fact that the average steamboatman is a conservatist par excellence. He is wedded to old methods, dislikes new ones, and, consciously or unconsciously, magnifies the dangers to be encountered or the damages to be suffered in case of a change of methods. This bridge is a novelty just at present, but will soon cease to be so. Any one of the tows which the Board saw pass the bridge on March 31 we firmly believe could have been taken past by *one* properly-handled tug instead of requiring *five* tugs.

We can not conscientiously believe that any corporation will abandon terminal facilities on which it has expended $2,000,000 purely and simply on account of the construction of this bridge.

We are thus led to the following conclusions:

(1) The bridge, if completed upon the present plans, would constitute an unreasonable obstruction to navigation.

(2) We can not perceive the necessity for the legislation embodied in Senate bill No. 1842.

(3) We would recommend that the act of Congress approved June 16, 1886, be so amended as to require that the spans shall not be less than 50 feet above mean *high-water* mark, measuring to the lowest member of the bridge superstructure. With this height of spans 81 per cent. of the water traffic will be accommodated without requiring the draws to be opened. The bridge company would also be benefited in

that, not having to open the draws so often, there would be much less delay in the passage of trains, and hence less expense incurred.

(4) We would also recommend that the fender-piling around the east pier be extended to a point on the shore opposite the south end of the crib-work erected in the center of the water-way, and that the time within which the bridge shall be completed be reasonably extended.

W. R. KING,
Major of Engineers.
EDW. MAGUIRE,
Captain of Engineers.

NEW YORK CITY, *April* 10, 1888.

SUPPLEMENTAL REPORT OF THE BOARD OF ENGINEERS.

NEW YORK CITY, *May* 5, 1888.

GENERAL: The Board of Engineers convened by Special Orders Nos. 8 and 9, current series, Headquarters Corps of Engineers, has carefully considered the questions contained in the indorsement of the Secretary of War of April 28, 1888, and has the honor to report, in answer to the several questions, as follows:

Q. 1. Cost of changes in the bridge recommended by the report of the majority of the Board.

The Board is of opinion that the cost of these changes will be about $143,000.

Q. 2. Cost of changes in the bridge recommended by the minority.

The Board is of opinion that the cost of these changes will be about $38,000.

Q. 3. Cost of increasing the length of the draw on each side of the pivot to 300 feet (no increase in height of bridge).

The Board is of opinion that the pivot truss of 500 feet, as now being built, can not be lengthened practically by 100 feet so as to give water-way spans of 300 feet. All the members of the original truss would have to be enlarged, which can not be done in a satisfactory manner, and it would be cheaper in the end to build a new truss of the dimensions required, namely, 600 feet. The Board is of the opinion that the present bridge could be altered so as to contain a 300-foot pivot draw for the sum of $125,000.

Q. 4. What will be the cost of the necessary widening and deepening of the Kill at or near the bridge on the Staten Island side if provided for in the river and harbor propriation?

Taking the cost of the land at $500 per acre and the price of dredging at 25 cents per yard the cost will be about $9,500.

All of which is repectfully submitted.

THOS. LINCOLN CASEY,
Colonel, Corps of Engineers.
W. R. KING,
Major of Engineers.
EDW. MAGUIRE,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

W W 3.

REPORT OF BOARD OF ENGINEERS ON SENATE BILL NO. 1850, FIFTIETH CONGRESS, FIRST SESSION, TO AUTHORIZE THE CONSTRUCTION OF A BRIDGE ACROSS THE STATEN ISLAND SOUND, KNOWN AS ARTHUR KILL AND KILL VON KULL, AT OR NEAR THE TOWN OF WESTFIELD, STATEN ISLAND, AND TO ESTABLISH THE SAME AS POST-ROAD.

NEW YORK CITY, *April* 10, 1888.

GENERAL: The Board of Engineers convened by special orders Nos. 8 and 9, current series, from the headquarters Corps of Engineers, and to which was referred by your indorsement of March 2, 1888, Senate bill 1850 for consideration and report, has the honor to state:

That Senate bill 1850 authorizes the construction of a bridge across the waters of the Arthur Kill from some point or points between the town of Westfield, Staten Island, Richmond County, New York, to some point or points in Middlesex County, in the State of New Jersey, as a foot-bridge, wagon-road, and railway bridge. The bridge is to be a pivot draw-bridge, with spans not less than 200 feet in the clear, the other spans to be not less than 250 feet, if the proper location of the draw will admit of spans of this width, and the height of the superstructure is to be not less than 15 feet above low water, or 10 feet above extreme high water, measuring to the bottom chord of the bridge; or the bridge may be a lifting bridge.

By the bill, the bridge may be placed at any point of a portion of the Kill 5½ miles in length. This reach is in the lower half of the stream and where the waters of the Kill have their greatest width. Taking into consideration the amount and character of the commerce and navigation over the stream, the Board is of opinion that the bridge proposed in the bill would be a serious obstruction to navigation, and should not be constructed. The Board would recommend in its stead a bridge having a clear height of superstructure above mean high water of 50 feet, a clear span 500 feet in width over a channel-way of 13 feet depth at low water, and a draw-span next to this span of at least 200 feet in width. The other spans of the bridge should not be less than 250 feet in the clear.

Section 6 of the same bill authorizes the construction of a suspension, cantilever, or lifting bridge over the Kill Von Kull, to and from some point or points commencing on the northerly side of Third street and York avenue, in the village of New Brighton, Staten Island, Richmond County, in the State of New York, to some point or points at or near Constable's Point, in the State of New Jersey, of such a height or in such a manner as not to interfere with the free navigation thereof by vessels and boats customarily navigating the same.

In view of the extensive commerce passing the position proposed for this bridge, being not only that coming through the Arthur Kill, but in addition that from Elizabethport, Newark Bay, and the north shore of the Kill Von Kull, the latter being extensively carried on by ocean-going ships, the Board is of opinion that this bridge when built should be a cantilever bridge of three bays, spanning the entire water-way, the center bay to be not less than 900 feet in width in the clear, and furnishing a clear height over the channel-way at mean high water of at least 150 feet.

THOS. LINCOLN CASEY,
Colonel, Corps of Engineers.
HENRY M. ROBERT,
Lieut. Col. of Engineers.
PETER C. HAINS,
Lieut. Col. of Engineers.
W. R. KING,
Major of Engineers.
EDW. MAGUIRE,
Captain of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

W W 4.

HIGHWAY BRIDGE ACROSS THAT PART OF THE WATERS OF LAKE CHAMPLAIN LYING BETWEEN THE TOWNS OF NORTH HERO AND ALBURGH, VERMONT, AUTHORIZED BY ACT OF CONGRESS APPROVED JUNE 20, 1884.

LA GRANGE, NORTH HERO, VT.,
August 28, 1886.

DEAR SIR: I inclose herewith a letter just received from our Senator, George F. Edmunds, in regard to a bridge we are now building from the town of North Hero, Vt., to the town of Alburgh, Vt., across Lake Champlain, calling our attention to the fact that we have never obtained the approval of the War Department.

We supposed we had complied with every requirement of the law in regard to the matter until we received this letter.

We obtained a charter from the General Government, also from our State in 1884, which we supposed was all that was required of us.

If you will please inform us what steps we shall take now in regard to the matter, that we may be guided thereby, we would be greatly obliged.

I am, sir, very respectfully, yours,

D. B. TOWN.

To the HONORABLE SECRETARY OF WAR.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 4, 1886.

Respectfully returned to the Secretary of War.

"An act to authorize the construction of a highway bridge across that part of the waters of Lake Champlain lying between the towns of North Hero and Alburgh, in the State of Vermont," was approved June 20, 1884 (U. S. Statute, vol. 23, pages 49, 50).

The second section of the act provides—

> That the structure authorized by the preceding section shall be built and located under and subject to such regulations for the security of navigation of such waters as the Secretary of War shall prescribe, and shall be provided with such suitable and convenient draw as the said Secretary shall deem needful for the proper purposes of navigation, etc.

It does not appear that the requirements of law have been complied with, and it is suggested that the plans of the bridge be submitted without delay, and in submitting them, that the parties interested comply with the requirements of the rule of the Secretary of War of July 31, 1886, in reference to bridge plans requiring his approval.

The attention of the parties interested should be invited to the provision of section 6 of the act approved February 22, 1883, Stat. at Large, vol. 22, page 423.

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen., *U S. A.*,
in charge of office.

[Second indorsement.]

WAR DEPARTMENT, *September* 7, 1886.

The suggestions of the officer in charge of the office of the Chief of Engineers are concurred in, and he will take the necessary steps by correspondence with the proper authorities to place the case in condition to be submitted to the Secretary of War for final action.

By order of the Acting Secretary of War.

JAY STONE,
Acting Chief Clerk.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
November 18, 1886.

Respectfully referred to Major M. B. Adams, Corps of Engineers, for his information and for examination and report.

The bridge referred to is authorized by an act of Congress approved June 20, 1884; copy with the papers.

Major Adams will report whether the location and plan of the bridge is in strict conformity with the acts of Congress authorizing its construction.

To be returned.

By command of Brigadier-General Duane.

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen. U. S. A.

[Fourth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 16, 1886.

Respectfully returned to the Secretary of War through the Acting Judge-Advocate General, U. S. A., inviting attention to the accompanying report of Major M. B. Adams, Corps of Engineers, from which it will appear that the bridge in question is already built; that it affords the only highway communication from North Hero Island to the mainland, and gives ready passage between the island and the railroad station on the Vermont Central Railroad at East Alburgh.

Major Adams considers the bridge as slight an obstruction to navigation as any bridge crossing the waters of Lake Champlain at any point; its draw gives a width of 78 feet, while that of the Lamoil Valley Extension Railroad Bridge is really only about 36 feet.

Major Adams concludes his report as follows:

> Upon careful consideration of all these facts, I have the honor to recommend the approval of this bridge in both its plan and location, and would respectfully recommend as follows for its management and lighting:
>
> That the draw shall be opened promptly by the proper authorities of the bridge upon the ordinary reasonable signal from any boat that may wish to effect a passage through it, and the bridge shall be lighted according to the usual prescribed rules made and provided by the Light House Board to govern in all such cases, both the operating of the draw and lighting of the bridge to be done at the expense of the bridge-owners.

In view of the above statements, and for the reasons more fully set forth in Major Adams's report, the plans and location of the "Highway bridge across that part of the waters of Lake Champlain lying between the towns of North Hero and Alburgh, in the State of Vermont," as provided for by the act of June 20, 1884, are recommended for approval.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Fifth indorsement.]

WAR DEPARTMENT,
January 13, 1887.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
January 22, 1887.

Respectfully returned to Major M. B. Adams, Corps of Engineers, inviting attention to the foregoing indorsements (fourth and fifth), by which he will be guided.

Major Adams will advise the bridge authorities acccordingly, and will see that the requirements of the War Department are fully complied with.

After such record has been taken as may be required for the files of his office, Major Adams will return the papers, with report of his action thereon.

By command of Brigadier-General Duane.

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

[Seventh indorsement.]

UNITED STATES ENGINEER OFFICE,
Burlington, Vt., January 26, 1887.

Respectfully returned to the Chief of Engineers, U. S. A., having made the necessary records, and with the information that the bridge authorities have been notified of the approval of the plans and location of their bridge, and requested to inform me what rules govern the operating of the draw and lighting of the bridge at the present time.

M. B. ADAMS,
Major of Engineers.

[Eighth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 5, 1887.

Respectfully returned to Major M. B. Adams, Corps of Engineers, calling attention to fourth indorsement, and to the quotation from his report contained therein, which was approved by the Secretary of War.

Major Adams will inform himself as to the rules which should govern the lighting of the bridge, and prescribe such regulations for the operating of the draw as the nature of the case would seem to require; and advise this office accordingly.

To be returned.

By command of Brigadier-General Duane.

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

[Ninth indorsement.]

UNITED STATES ENGINEER OFFICE,
Burlington Vt., February 16, 1887.

Respectfully returned to the Chief of Engineers, U. S. Army, with a copy of a letter sent to the authorities of the North Hero Bridge, which is believed to convey them all needed regulations for the operating of its draw and the lighting of the bridge, as well as to meet your instructions in the premises.

M. B. ADAMS,
Major of Engineers.

W W 5.

BRIDGE OF THE KANSAS CITY, TOPEKA AND WESTERN RAILROAD COMPANY ACROSS THE MISSOURI RIVER AT SIBLEY, MISSOURI. AUTHORIZED BY ACT OF CONGRESS APPROVED JULY 3, 1884.

[Britton & Gray, attorneys and counsellors at law.]

WASHINGTON, D. C., *March* 18, 1887.

SIR: By act of Congress approved July 3, 1884 (23 Stats., 67), the Kansas City, Topeka and Western Railroad Company is authorized to construct a bridge "over the Missouri River at or near Sibley, in the State of Missouri;" and by section 7 the plan and location thereof is made subject to your approval.

Pursuant to this authority we file herewith:

(1) The plans of said bridge as proposed to be constructed by said railroad company.

(2) Certified copy of the articles of consolidation evidencing the creation and present existence of the Kansas City, Topeka and Western Railroad Company.

(3) Certified extract from the record of the meeting of the board of directors of said railroad company accepting the act of Congress authorizing the construction of said bridge.

(4) Certified transcript of the records of said railroad company showing the election of the present officers and directors thereof.

(5) Letter from W. B. Strong, president of said company, showing appointment of A. A. Robinson, as chief engineer thereof.

(6) Certificates, in triplicate, of said W. B. Strong, as president, and A. A. Robinson, chief engineer, of said company, as to the correctness of the plans of said bridge as herewith filed.

Whereon we ask your immediate approval of said plan and location in accordance with the requirements of the act.

Very respectfully,

BRITTON & GRAY,
Attorneys for K. C., T. and W. R. R. Company.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 31, 1887.

Respectfully returned to the Secretary of War, through the Acting Judge-Advocate-General, U. S. Army.

The within plan and location of the proposed bridge are in accordance with the provisions of "an act to authorize the construction of a bridge over the Missouri River at or near Sibley, in the State of Missouri," passed July 3, 1884, and there appears to be no objection to their approval by the Secretary of War.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., April 1, 1887.

The evidence in this case, under the rule of July 31, 1886, being furnished by the company, the papers are returned to the Secretary of War, with draught of approval of plans, etc.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

[Third indorsement.]

WAR DEPARTMENT,
April 14, 1887.

Respectfully returned to the Chief of Engineers with the accompanying duplicate copy of the instrument, which has been approved by the Secretary of War, for file in the office of the Chief of Engineers. The original copy has been furnished to Messrs. Britton & Gray, the attorneys of the Kansas City, Topeka and Western Railroad Company.

By order cf the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

REPORT OF LIEUTENANT-COLONEL CHARLES R. SUTER, CORPS OF ENGINEERS, PRESIDENT OF THE MISSOURI RIVER COMMISSION.

MISSOURI RIVER COMMISSION,
OFFICE OF THE PRESIDENT,
Saint Louis, Mo., March 25, 1887.

SIR: In accordance with instructions conveyed by your letter of 21st instant, I have to report that the plans for the proposed bridge over the Missouri River at Sibley, Mo., have been carefully examined and found to comply with the requirements of the special act of Congress authorizing the construction of this bridge. The plans show a high bridge with three 400 foot spans over the water-way of the river. The height under floor beams, in this case the lowest portion of the superstructure, is given as 50 feet above the high water of 1844, which is 7 feet higher than 1881, about the highest flood since the former date. The bridge therefore will fully comply with all the requirements deemed advisable by the Missouri River Commission.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers,
President Missouri River Commission.

The CHIEF OF ENGINEERS, U. S. A.

W W 6.

BRIDGE OF THE CHICAGO, SAINT LOUIS AND NEW ORLEANS RAILROAD COMPANY ACROSS THE OHIO RIVER AT EAST CAIRO, KENTUCKY, AUTHORIZED BY ACTS OF CONGRESS AUTHORIZING THE CONSTRUCTION OF BRIDGES ACROSS THE OHIO RIVER, APPROVED DECEMBER 17, 1872, AND FEBRUARY 14, 1883.

OFFICE OF THE CHICAGO, SAINT LOUIS
AND NEW ORLEANS RAILROAD COMPANY,
New York, March 26, 1887.

SIR: I have the honor to transmit herewith papers, maps, and plans relating to the bridge over the Ohio River at East Cairo, Ky., which the Chicago, Saint Louis and New Orleans Railroad Company proposes to build under a charter granted to it by the State of Kentucky, and in accordance with the acts of Congress authorizing the construction of bridges over that river.

These papers are more fully described in the minutes of the meeting of the Board of Directors of this company, held this day, of which a certified copy accompanies this application.

The act of Congress granting lands to the States of Illinois, Mississippi, and Alabama required the railroads to build "to a point at or near the junction of the Ohio and Mississippi rivers." The site thus forced on this company presents engineering difficulties of such magnitude that we deemed it a necessity to obtain, if possible, some modification of the requirements of the general laws of Congress. This necessity was fully explained to a Board of United States Engineers, but although their report shows that they appreciated the disadvantages to the railroad company in constructing and operating a bridge such as the law requires, they were unwilling to recommend a modification of the law in this case.

We have therefore decided to build exactly in accordance with the requirements of the law and of the Board of Engineers. Indeed, their requirements have been more than complied with, by providing two spans of 500 feet in the clear instead of one, and, in order to accommodate the steam-boats and tows going up-stream at high water, spans of great length and of the full height required for the channel-span have been continued from bank to bank, entirely across the river.

It will require about two and a half years to build this bridge. Although the traffic now crossing the river at this point is constantly increasing both in volume and in value, it is seriously hindered by the delays incident to transfer by boat.

We desire, and have determined, to continue the construction of the bridge without delay and to complete it as soon as possible, and therefore respectfully request the early approval of the accompanying plans, etc., which will be presented by Mr. E. L. Corthell, engineer of the bridge, in person. Mr. Corthell is authorized to act for this company in any and all matters relating to the approval of the plans.

I am, sir, yours, respectfully,

STUYVESANT FISH,
Vice-President of the Chicago, Saint Louis and New Orleans Railroad Company.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 28, 1887.

Respectfully returned to the Secretary of War through the Acting Judge-Advocate-General, U. S. Army.

Upon examination of the within plan and location of the proposed bridge of the Chicago, Saint Louis and New Orleans Railroad Company across the Ohio River at East Cairo, Ky., it is believed that they conform to the requirements of the Board of Engineers as contained in its report of May 7, 1886, and printed as House Mis. Doc. No. 339, Forty-ninth Congress, first session (copy herewith), and also with the provisions of the act of December 17, 1872, and the supplementary act of February 14, 1883, authorizing the construction of bridges across the Ohio River, etc. (copies herewith), and therefore no objection is known to their approval by the War Department if the rule of the War Department dated July 31, 1886, has also been complied with.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE GENERAL'S OFFICE,
Washington, D. C., March 30, 1887.

Respectfully returned to the Secretary of War with drafts of formal approval by the Secretary of the design, drawings, and maps submitted by the Chicago, Saint Louis and New Orleans Railroad Company. The company presents in lieu of a copy of the minutes of its organization duly authenticated, a memorandum signed by E. L. Corthell, representing Chicago, Saint Louis and New Orleans Railroad Company, and sworn to before a notary public of this city. It is for the Secretary of War to determine whether this document, in connection with the volume of laws and documents filed by the company, may be accepted as sufficient evidence of the fact in question.

G. NORMAN LEIBER,
Acting Judge-Advocate General.

[Third indorsement.]

WAR DEPARTMENT, *April* 1, 1887.

Respectfully returned to the Chief of Engineers for file in his office; the original copy of the instrument having been sent to Mr. E. L. Corthell, No. 34 Nassau street, New York City, this date.

By order of the Secretary of War.

SAM'L HODGKINS,
Acting Chief Clerk.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., April 11, 1888.

SIR: Under date of April 1, 1887, the Secretary of War approved certain drawings showing design, location, etc., of the bridge of the Chicago, Saint Louis and New Orleans Railroad Company across the Ohio River at Cairo, Ill., proposed to be erected under acts of Congress approved December 17, 1872, and February 14, 1883; and in order that the Secretary of War may be fully advised as to the manner in which such bridge, piers, etc., are being constructed, and as to whether the plans approved by him are being complied with and the bridge built accordingly, it is desired that you supervise its construction so far as may be necessary to enable you to supply the information required.

Copies of two of the drawings, with copy of the approval of the Secretary of War attached, are sent herewith for your guidance. The remaining drawing, showing location of proposed bridge without contours of the bottom of the river, was sent you March 30, 1888.

By command of Brigadier-General Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. WM. E. MERRILL,
Corps of Engineers.

W W 7.

FREE WAGON BRIDGE ACROSS THE CUMBERLAND RIVER NEAR THE CITY OF NASHVILLE, TENNESSEE, AUTHORIZED BY ACT OF CONGRESS APPROVED MARCH 3, 1887.

NASHVILLE, TENN., *April* 10, 1887.

SIR: In obedience to the act of Congress and the rule of the Department of July 31, 1886, I have the honor to-day to forward by mail to your address a copy of the specifications of the North Nashville Bridge, and by express the general plan of the North Nashville Bridge with a duplicate (tracing) of the same, which plans and specifications are necessary to accompany the application of the Bridge Commissioners for the approval of the plans so the work may proceed.

Very respectfully, your obedient servant,

E. F. FALCONNET,
Consulting Engineer.

The Hon. SECRETARY OF WAR.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 19, 1887.

Respectfully referred to Lieut. Col. J. W. Barlow, Corps of Engineers, for his information and for examination and report. Colonel Barlow will see whether the plans conform to the requirements of the act of March 3, 1887, authorizing the construction of the bridge (copy herewith). Colonel Barlow will also call attention of the bridge authorities to the accompanying rule of the Secretary of War and request compliance with the same. Papers under the rule to be furnished in duplicate.

By command of Brigadier-General Duane.

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

[Second indorsement.]

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., April 30, 1887.

Respectfully returned to the Chief of Engineers with report of this date.

J. W. BARLOW,
Lieut. Col. of Engineers.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 7, 1887.

Respectfully returned to the Secretary of War through the Acting Judge-Advocate General, U. S. Army, inviting attention to the accompanying report of Lieut. Col. J. W. Barlow, Corps of Engineers, from which it will appear that the bridge is held to be in conformity with the "Act to give the assent of Congress to the construction of a free bridge by the county of Davidson, Tennessee, over the Cumberland River," approved March 3, 1887. His views are concurred in by this office, and it is recommended that the plan be approved accordingly.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., May 11, 1887.

Respectfully returned to the Secretary of War, with formal instrument for his approval (prepared in duplicate) of the design and drawings, and proposed location of the bridge across the Cumberland River, near the city of Nashville, Tenn., authorized by the act of Congress approved March 3, 1887 (page 471, Statutes of 1886–1887).

G. NORMAN LEIBER,
Acting Judge-Advocate-General.

REPORT OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS, ACCOMPANYING SECOND INDORSEMENT ON FOREGOING COMMUNICATION.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., April 30, 1887.

SIR: In compliance with indorsement of the Chief of Engineers, dated April 19, 1887, on communication of E. F. Falconnet, consulting engineer, to the honorable Secretary of War, herewith, I have the honor to submit the following report:

The act of Congress authorizing the construction of the bridge in question provides that if the bridge be made with unbroken or continuous spans, the spans shall not be less than 164 feet in the clear, the main span to be over the main channel of the river, and the lowest part of the superstructure not less than 34 feet above extreme high-water mark; the bridge to be at right angles to, and its piers parallel with, the channel of the river.

The proposed bridge is of this character, and the adopted plans and specifications for its construction provide for a higher bridge with wider spans than the act requires.

The drawings provide for a bridge having a main or channel span 250 feet, and adjacent spans on either side 200 feet from center to center of piers. These spans in the clear will, therefore, be at the water's surface at ordinary stages about 235 feet and 185 feet, respectively. The height of the main span will be 44 feet above the highest recorded stage of the river, or 99 feet above low water. The plan shows that the bridge will be at right angles to the current, and the piers parallel therewith.

The requirements of section 4 of the act, in regard to the preparation of a topographical map of the locality and its vicinity, have been substantially complied with; the map presented being a fair representation of the general characteristics of that section of the river.

Pending the action of Congress upon the bill giving its consent to the construction of this bridge, objections were raised by adverse interests which were satisfied by a modification in the height of the bridge, which placed the superstructure 10 feet higher than was at first proposed.

To insure the passage of the act during the then current session of Congress, and thus enable the construction of the bridge to go forward without loss of time, the consent of all parties was obtained to the passage of the act without amendment, upon the specific understanding that the bridge would be built 44 feet above high water, instead of 34 feet as specified in the act.

As previously stated, the plans have been modified to conform to this increased height and contracts have been made in compliance therewith, and there now appears to be no opposition from any quarter to the construction of the bridge according to the modified plan; and as the greater includes the less in the matter of height, these plans are held to be in accord with the act above mentioned.

The county of Davidson, Tennessee, the grantee, by and through its County Court and duly appointed and empowered Board of Bridge Commissioners, has accepted and is carrying out the plans submitted for the construction of the North Nashville Bridge, and has also accepted the provisions of the act of Congress approved March 3, 1887, in reference thereto, and the parties in interest have filed a paper, in duplicate, properly authenticated and transmitted herewith, setting forth these facts, in compliance with War Department rule, July 31, 1886.

It is noted that on this paper the date is omitted when the meeting was held by the County Court accepting the provisions of the act, but it is certified as of record that it was during the April term of said court.

Very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers.

CHIEF OF ENGINEERS, U. S. A.

LETTER OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., April 6, 1888.

SIR: I have the honor to transmit herewith a communication of March 31, from certain parties in interest, having reference to the height of the Davidson County Bridge over the Cumberland River, now constructing under the provisions of act approved March 3, 1887. (Public, 123.)

The act provides for this bridge a height of 34 feet above extreme high water, but by a compromise with the opposing interests (represented by the within communication), the plans, etc., presented to the War Department under the act provided for a bridge at least 44 feet above extreme high water, and said plans were approved by the Secretary of War.

It now appears that by reason of various unfortuitous contingencies, during the progress of construction, the height that will be secured is only 43 feet above extreme high water, and it is understood that now the parties in interest seek, through the inclosed communication, the approval of the Secretary of War to the change in height, under the provisions of section 4 of said act.

Under the circumstances, and the reduction in height being comparatively small, I respectfully recommend that the "change of plan," so far as to authorize the construction of said bridge "having the lowest part of its superstructure at least 43 feet above extreme high-water mark as understood at the point of location," may be approved.

Very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers.

CHIEF OF ENGINEERS, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 14, 1888.

Respectfully submitted to the Secretary of War.

It appears from the within communication from Lieut. Col. J. W. Barlow, Corps of Engineers, and its accompanying inclosure, that the approved plan of the bridge in question provides for a height of at least 44 feet above extreme high water, but that, owing to an error made in the early surveys for ascertaining the high-water mark in the Cumberland River, upon which the plans were based, the bridge as being constructed will only attain a height of 43 feet above extreme high water, which is stated by parties representing the opposing interests to be sufficient for their purposes, and who consent to the present grade and derrequest that it be approved by the Secretary of War.

Colonel Barlow recommends that the change of plan so far as to authorize the construction of the bridge "having the lowest part of its superstructure at least 43 feet above extreme high-water mark as understood at the point of location" may be approved.

No objection appears to authorizing the change of plan as requested, and it is accordingly recommended that it be approved under the provisions of section 4 of the act of March 3, 1887.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
April 17, 1888.

Respectfully referred to the Acting Judge-Advocate-General to prepare the formal approval.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., April 21, 1888.

Respectfully returned to the Secretary of War, with formal instrument prepared, in duplicate, for his approval.

G. NORMAN LEIBER,
Acting Judge-Advocate-General.

[Fourth indorsement.]

WAR DEPARTMENT, *April* 23, 1888.

Respectfully returned to the Chief of Engineers, to have the acceptance and certificate attached to the formal approval signed.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 25, 1888.

Respectfully returned to Lieut. Col. J. W. Barlow, who is requested to have the accompanying acceptance and certificate signed by the proper parties.

All the papers to be returned to this office.

By command of Brigadier-General Duane.

JAS. C. POST,
Major of Engineers.

[Sixth indorsement.]

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., May 5, 1888.

Respectfully returned to the Chief of Engineers.

The acceptance was at first signed by two of the Bridge Commissioners and duly certified by the clerk of the county court of Davidson County.

The intent of the instrument to obtain the signatures of the full board of Bridge Commissioners was evident, so the papers were returned for the signature of B. H. Beazley, which was obtained.

The clerk of the county court being then absent, the old certificate—authenticating two names only—was canceled, and the certificate as originally written was duly executed under seal, by the deputy clerk of said county, who has full power to so certify under the laws of Tennessee.

J. W. BARLOW,
Lieut. Col. of Engineers.

[Seventh indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 8, 1888.

Respectfully returned to the Secretary of War, with the acceptance and certificate attached to the formal approval signed as directed by the fourth indorsement.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Eighth indorsement.]

WAR DEPARTMENT, *May* 11, 1888.

Respectfully returned to Lieut. Col. J. W. Barlow, through the Chief of Engineers, with the acceptance signed by the Secretary of War this date.

By order of the Secretary of War.

SAM'L HODGKINS,
Acting Chief Clerk.

[Ninth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 12, 1888.

Respectfully returned to Lieutenant-Colonel Barlow inviting attention to the foregoing indorsement.

This paper to be returned.

By command of Brigadier-General Duane.

JAS. C. POST,
Major of Engineers.

[Tenth indorsement.]

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., May 16, 1888.

Respectfully returned to the Chief of Engineers.

The acceptance signed by the Secretary of War has been forwarded to the board of Bridge Commissioners for constructing the bridge therein referred to on this date.

J. W. BARLOW,
Lieut. Col. of Engineers.

COMMUNICATION SUBMITTED WITH FOREGOING LETTER.

NASHVILLE, TENN., *March* 31, 1888.

DEAR SIR: It has been ascertained that an error occurred in the early surveys in ascertaining the high-water mark in the Cumberland River, the result of which is that the masonry piers and abutments of the North Nashville Bridge over said river, near Hyde's Ferry, have been built to such a height that the superstructure will be only 43 feet above said high-water mark, in lieu of 44 feet, as intended.

Now, in view of the fact that the additional labor, expense, and time required to elevate the entire structure 1 foot higher will be very great, we, as representing the interested parties, believing that the error was purely accidental, and that the present elevation will be sufficient for our purposes, do cheerfully consent that the present grade shall be adhered to, and unite in requesting that the height of the structure as now built be approved by you.

Very respectfully,

I. N. HAMILTON,
President pro tem. Cumberland Commission.
T. G. RYMAN,
Superintendent N. C. and N. and E. P. Kt. Co.
JOHN RUHM,
Chairman.
ED. LAMENT,
Secretary Bridge Commission for the County of Davidson.

Lieu. Col. J. W. BARLOW,
Corps of Engineers.

W W 8.

BRIDGE OF THE OHIO RIVER RAILROAD COMPANY ACROSS GREAT KANAWHA RIVER NEAR POINT PLEASANT, WEST VIRGINIA, AUTHORIZED BY ACT OF CONGRESS, APPROVED MARCH 3, 1887, FOR THE CONSTRUCTION OF BRIDGES ACROSS THE GREAT KANAWHA RIVER BELOW THE FALLS AND TO PRESCRIBE THE DIMENSIONS OF THE SAME.

OFFICE OF OHIO RIVER RAILROAD COMPANY,
Parkersburgh, W. Va., March 20, 1887.

DEAR SIR: The Ohio River Railroad Company is a corporation organized under a certificate of incorporation issued by the State of West Virginia to the Wheeling, Parkersburgh and Charleston Railroad Company, and dated the 18th day of April, 1881.

Exhibit A, accompanying this application, is a copy of said certificate of incorporation, duly authenticated by the secretary of state for West Virginia.

Under this certificate of incorporation the company was duly organized.

Exhibit B, accompanying this application, is a duly-authenticated copy of the minutes of the meetings organizing said company.

On December 27, 1882, the name of said company was changed to the Ohio River Railroad Company.

Exhibit C, accompanying this application, is a copy of the certificate declaring said change of name, duly authenticated by the secretary of state for West Virginia.

The said railroad company constructed its railroad from the city of Wheeling, in the State of West Virginia, to the town of Point Pleasant, in said State, during the years 1883 to 1886, inclusive.

The last annual meeting of the stockholders of the company was held on May 13, 1886.

Exhibit D is a duly-authenticated extract from the minutes of said meeting, showing the board of directors elected at said meeting.

A meeting of said board of directors was held on May 13, 1886.

Exhibit E, accompanying this application, is a duly-authenticated extract from the minutes of said meeting, showing the officers of the company elected at said meeting.

The Code of West Virginia, chapter 54, section 53, provides that any railroad company may extend its road beyond either or both of its termini.

Exhibit F, accompanying this application, is a copy of said act.

In accordance with said act the stockholders of said company, at a special meeting duly called and held in the city of Parkersburgh, W.

Va., on the 5th day of February, 1887, passed a resolution authorizing an extension of their railroad from its former terminus at Point Pleasant to a connection with the Chesapeake and Ohio lines, at or near Huntington, W. Va.

Exhibit G, accompanying this application, is a duly authenticated copy of said resolution.

In pursuance of said resolution of the stockholders of said company, the board of directors of said company, at a meeting duly called and held in the city of Parkersburgh, W. Va., on the 28th day of February, 1887, passed a resolution that in accordance with the provisions of chapter 54, section 53, of the code of West Virginia, cited above, a certificate stating the points at or near which such extension shall commence and terminate be filed with the secretary of state.

Exhibit H, accompanying this application, is a duly authenticated copy of this resolution.

In accordance with said resolution, a certificate to that effect was filed with the secretary of state for West Virginia on the 7th day of March, 1887.

Exhibit I, accompanying this application, is a copy of said certificate, duly authenticated by the secretary of state for West Virginia.

Pursuant to the authority, given as aforesaid, the said railroad company has located an extension of its line of railroad from the town of Point Pleasant to the town of Huntington, State of West Virginia, crossing the Great Kanawha River near the town of Point Pleasant.

The code of West Virginia, chapter 44, section 22, reads:

> Corporations may be formed under the provisions of the first twenty-four sections of chapter fifty-four of this code for the purpose of bridging the Ohio River. Any such corporation or *any railroad corporation* is hereby authorized to construct and maintain a bridge across said river in the manner now, or which may hereafter be, provided by the Congress of the United States, and upon complying with the requirements, conditions, and provisions so prescribed, and not otherwise. * * * The provisions of this section as to the building of a railroad bridge across the Ohio River shall extend to and include the Great Kanawha and Big Sandy rivers.

Under the authority given by said act, the Ohio River Railroad Company has located its bridge across the Great Kanawha River in accordance with the provisions of the act of Congress, approved March 3, 1887, which regulates the bridging of said river.

Exhibit J, accompanying this application, is a copy of said act.

The said company has duly accepted the provisions of said act of Congress by resolution of its board of directors passed at a meeting held in the city of Parkersburgh, W. Va., on the 11th day of March, 1887.

Exhibit K, accompanying this application, is a duly authenticated copy of said resolution.

Said company has given the notice required by section 3 of said act by publication for two weeks in newspapers having a wide circulation, to wit, in two newspapers in each of the cities of Louisville, Ky., Cincinnati, Ohio, Gallipolis, Ohio, and Charleston, W. Va.

Exhibit L, accompanying this application, consists of affidavits to the publication of said notice in eight newspapers, as stated above.

The said company herewith submits for your approval a design and drawings of the bridge and piers and a map of the location made in accordance with the provisions of said act of Congress. Also another map is herewith submitted, as required by said act of Congress, giving an accurate representation of the bottom of said river above and below the proposed location of said bridge. Said company respectfully requests that this design and these maps be referred to a Board of Engineers for further consideration, as provided by the terms of said act.

All of which, with the agreement that said company will in every respect comply with the provisions of said act, is respectfully submitted, and this request is signed by the president of the company under authority granted him by the resolution of the board of directors accepting the provisions of the said act (Exhibit K).

OHIO RIVER RAILROAD COMPANY,
By GEO. W. THOMPSON,
President.

HON. WILLIAM C. ENDICOTT,
Secretary of War.

Dated at Parkersburgh, W. Va., this 21st day of March, 1887.

STATE OF WEST VIRGINIA,
County of Wood, ss:

I, E. W. Warnick, a notary public for county and State aforesaid, do certify that Geo. W. Thompson, president Ohio River Railroad Company, whose name is signed to the foregoing writing, bearing date March 20, 1887, this day acknowledged same before me on behalf of said company, and as such president in my said county.

Given under my hand this 20th day of March, 1887.

E. W. WARNICK,
Notary Public.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 25, 1887.

Respectfully returned to the Secretary of War.

"An act to authorize the construction of bridges across the Great Kanawha River below the Falls, and to prescribe the dimensions of the same," approved March 3, 1887, provides that the maps and drawings of the proposed bridge shall be referred to a Board of Engineer officers for examination and report, and it is accordingly recommended that a Board be constituted to consist of the following officers of the Corps of Engineers: Col. William P. Craighill, Lieut. Col. W. E. Merrill, Maj. J. C. Post. The Board to assemble at Charleston, W. Va., upon the call of the senior member, at such time as the other duties of the members will permit, and to consider and report upon the plans and location of the bridge as submitted by the bridge authorities. The Board to be authorized to hold public sessions at a convenient point, of which due notice and invitation shall be given to interested parties, and to visit the locality of the proposed bridge, and have such examinations made as may be deemed necessary to the proper consideration of the subject.

With the sanction of the Secretary of War the Board will be convened by orders from this office.

* * * * * * *

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
March 26, 1887.

Approved as recommended by the Chief of Engineers.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 21, 1887.

Respectfully returned to the Secretary of War inviting attention to the report of the Board of Engineers (dated the 15th instant), constituted, with his sanction, by orders from this office in compliance with the requirements of "An act to authorize the construction of bridges across the Great Kanawha River below the Falls, and to prescribe the dimensions of same," approved March 3, 1887.

It will be seen that the Board recommends "that the site of the bridge and the location of the piers be approved as proposed. The level of low water, from which according to the law the height of the bridge is to be measured, should, it is suggested, be determined by the officer in charge of the improvement of the Great Kanawha River, who should also decide as to the proper location of the piers in accordance with the approved plans and be satisfied that the height of the bridge is right."

Attention is also invited to the accompanying letter, dated the 16th instant, from Col. William P. Craighill, Corps of Engineers, the president of the Board, recommending that "such supervision be exercised by the officer in charge of the improvement of the Great Kanawha River as may be necessary to prevent the use of 'insufficient foundations' for the piers and consequent 'riprap or other outside protection,' and to require that all coffer-dams or other temporary works be removed by the owners of the bridge before it be opened to traffic."

It is recommended that the views of the Board as set forth in its report and the accompanying letter of the president dated the 16th instant be approved.

The papers and drawings should be returned with the view to the preparation of duplicates, and in this connection the inquiry is suggested whether the rule of the War Department of July 31, 1886, contemplates the filing of *duplicates* of the *papers* as well as of the *maps* and *drawings*.

J. G. DUANE,
Brig. Gen., Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
April 27, 1887.

The report of the Board of Engineers, the recommendations of Colonel Craighill, and the Chief of Engineers are approved.

The papers are respectfully referred to the Chief of Engineers and the Acting Judge-Advocate-General to prepare the plans and papers in duplicate for the approval of the Secretary of War. Duplicates of the report of the Board and Colonel Craighill's letter should be submitted.

By order of the Acting Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 1, 1887.

Respectfully transmitted to the Acting Judge-Advocate-General, U. S. Army, with plans and papers in duplicate, as directed by the foregoing indorsement of the War Department.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Sixth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., June 6, 1887.

Respectfully returned to the Secretary of War.

The papers appear to be in compliance with the provisions of the rule of the War Department applicable to these cases, except that the extract from the minutes of the company shows that its organization was at first intended to be temporary. The other papers submitted, however, indicate that the company is at present permanently organized. The instruments of approval are herewith transmitted.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

[Seventh indorsement.]

WAR DEPARTMENT, *June* 15, 1887.

Respectfully referred to the Chief of Engineers for file in his office, one copy of the within instrument having been sent to Mr. George W. Thompson, president Ohio River Railroad Company.

By order of the Acting Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

REPORT OF BOARD OF ENGINEERS.

POINT PLEASANT, W. VA.,
April 15, 1887.

SIR: The Board of Engineers directed by your orders of March 28 to consider the plans and location of the bridge proposed by the Ohio River Railroad Company to be built over the Great Kanawha River, at Point Pleasant, has the honor to report as follows:

The Board assembled at Charleston April 14, and they had a session at Point Pleasant the next day. Notice of these meetings had been given in the newspapers of both those places. All persons who desired to do so were invited to appear and present their views on the subject before the Board. The attendance was not large on either occasion.

The site of the bridge and its vicinity were examined.

The law of Congress under which the bridge is proposed to be built was approved March 3, 1887. Its language conforms almost exactly to that recommended in the report of the Board dated June 10, 1884.

The officials of the railroad company, as shown by the papers and plans submitted to the Hon. Secretary of War, with the communication of March 20, from Mr. G. W. Thompson, president of the company, have complied with the requirements of the law, even going beyond it in giving "a clear opening" of 460 feet, whereas the law calls for but 400.

It is the recommendation of the Board that the site of the bridge and the locations of the piers be approved as proposed. The level of low water from which, according to the law, the height of the bridge is to be measured, should, it is suggested, be determined by the officer in charge of the improvement of the Great Kanawha River, who should also decide as to the proper location of the piers in accordance with the approved plans and be satisfied that the height of the bridge is right.

Your letter of instructions of March 29, 1887, and all the papers which accompanied it, are returned herewith. The maps are sent in a separate package by mail.

Respectfully submitted.

WM. P. CRAIGHILL,
Colonel of Engineers.
WM. E. MERRILL,
Lieut. Col. of Engineers.
JAS. C. POST,
Major of Engineers.

CHIEF OF ENGINEERS, U. S. A.

LETTER OF COLONEL WM. P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., *April* 16, 1887.

GENERAL: In sending forward to-day in a separate package the report of the Board of Engineers appointed to consider the subject of the bridge proposed to be erected near Point Pleasant over the Great Kanawha River, I have the honor to make a suggestion, which seems important.

Referring to the second section of the law of March 3, 1887, I recommend that such supervision be exercised by the officer in charge of the improvement of the Great Kanawha River as may be necessary to prevent the use of "insufficient foundations" for the piers and consequent "riprap or other outside protection," and to require that "all coffer-dams or other temporary works be removed by the owners of the bridge before it be opened to traffic."

* * * * * * *

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Colonel of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

LETTER TO COLONEL WM. P. CRAIGHILL, CORPS OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., *June* 17, 1887.

SIR: Referring to the report of the Board of Engineers of April 15, and your letter of April 16, 1887, respecting bridge to be built by the Ohio River Railroad Company across the Great Kanawha River at Point Pleasant, W. Va., I am directed to inform you that the plans and location recommended by the Board have received the approval of the Acting Secretary of War, upon the express conditions following:

(1) That the level of low water from which, as required by the act aforesaid, the height of the bridge is to be measured, and the proper location of the piers in accordance with the plans hereby approved, shall be determined by the officer in charge of the improvement of the Great Kanawha River.

(2) That such supervision of the construction of the proposed bridge be exercised by the officer in charge of the improvement of the Great Kanawha River as shall be necessary to prevent the use of insufficient foundation for the piers and consequent riprap or other outside protection, and to require that all coffer-dams and other temporary works be removed by the owners of the bridge before it is opened to traffic.

You will therefore please exercise such supervision of the proposed bridge as may be necessary to determine that the conditions imposed by the War Department are faithfully observed.

By command of the Acting Chief of Engineers.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Col. WM. P. CRAIGHILL,
Corps of Engineers.

W W 9.

BRIDGE ACROSS THE WEST CHANNEL OF THE DETROIT RIVER, TO CONNECT BELLE ISLE PARK WITH THE MAINLAND, AUTHORIZED BY ACT OF CONGRESS APPROVED JULY 20, 1886.

OFFICE BOARD OF PUBLIC WORKS,
Detroit, April 15, 1887.

SIR: The city of Detroit having been authorized by act of Congress approved July 20, 1886, to construct a bridge across the West Channel of the Detroit River, to connect Belle Isle with the mainland, the board of public works caused the necessary plans and specifications therefor to be prepared, and as required by said act forward the same to you for approval.

As this is a matter of importance to the people of the city of Detroit, the board of public works respectfully request that you give the same your earliest attention.

Respectfully, etc.,

JOHN CAMPBELL,
Secretary.

Hon. SECRETARY OF WAR.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 21, 1887.

Respectfully referred to Lieut. Col. O. M. Poe, Corps of Engineers, for examination and report as to whether the accompanying plans, etc., of the proposed bridge are in conformity with the requirements of the act of July 20, 1886 (for copy of act see page 37 of laws affecting the Corps of Engineers, Forty-ninth Congress, first session).

In this connection a copy of the rule of the War Department "to be observed when application is made pursuant to an act of Congress for approval by the Secretary of War of plans for a bridge," etc., is herewith, which it is requested may be furnished the bridge authorities for their information and guidance; the drawings and papers contemplated therein to be furnished in duplicate and duly authenticated.

By command of Brigadier-General Duane.

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

[Second indorsement.]

UNITED STATES ENGINEER OFFICE,
Detroit, May 18, 1887.

Respectfully returned to the office of the Chief of Engineers with report of this date.

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 25, 1887.

Respectfully returned to the Secretary of War, through the acting Judge-Advocate-General, U. S. Army, inviting attention to the accompanying report of Lieut. Col. O. M. Poe, Corps of Engineers, dated the 18th instant, from which it will appear that he has given the subject full and careful consideration, and has reached the conclusion that the plans and location of the bridge satisfy the requirements of the act of July 20, 1886, and may therefore be approved. His views are concurred in by this office.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., June 1, 1887.

Respectfully returned to the Secretary of War, with formal instrument for his approval (prepared in duplicate) of the design and drawing and map of location of the bridge across the west channel of the Detroit River, to connect Belle Isle Park with the mainland.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

[Fifth indorsement.]

WAR DEPARTMENT,
June 15, 1887.

Respectfully returned to the Chief of Engineers for file in his office, one copy of the within instrument having been sent to Mr. John Campbell, Secretary board of public works, Detroit.

By order of the acting Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., May 18, 1887.

SIR: In compliance with indorsement, dated office of the Chief of Engineers, April 21, 1887, on a communication of April 15, 1887, from the board of public works of the city of Detroit, Mich. (by John Campbell, secretary), submitting to the Secretary of War for approval, plans and specifications for a bridge over the west channel of Detroit River, to connect Belle Isle with the mainland, under act of Congress approved July 20, 1886, directing me to examine and report "whether the accompanying plans, etc., of the proposed bridge are in conformity with the requirements" of said act, and transmitting "a copy of the rule of the War Department 'to be observed when application is made pursuant to an act of Congress for approval by the Secretary of War of plans for a bridge,'" with instructions to furnish it to "the bridge authorities for their information and guidance," I have the honor to submit the following, viz:

The papers referred to me were received on the 24th of April and the copy of the rule of the War Department was transmitted to the board of public works on the same day.

The municipal government had not, at that time, formally accepted the conditions of the act of July 20, 1886, but the necessary action was then taken, and a certified copy thereof (in duplicate) is herewith transmitted. The plans and specifications, with the action of the municipal authorities thereto attached, assigning charge of the work to the Board of Public Works (all in duplicate and duly attested) were furnished and are herewith transmitted; also a copy in duplicate of the charter of the city of Detroit.

An examination of the plans and specifications for the proposed bridge reveals the following provisions to meet the requirements of the act:

1. *Location.*—Section 2 of the act requires that the bridge "shall be so located and constructed that the channel of said Detroit River shall not be unreasonably obstructed."

The location proposed is from the river terminus of the so-called Boulevard to a point about 1,000 feet above the lower end of Belle Isle, the axis of the bridge to make an angle of about 76 degrees with the direction of the channel. The object of this appears to be to make the bridge an exact prolongation of the Boulevard, as well as to get the shortest bridge and the most convenient landing on Belle Isle. Ordinarily a bridge at right angles with the channel would occupy the shortest line, but in this case the shores on either side of the proposed line fall away from the channel in such manner that a bridge at right angles with it would be a little longer than in the position proposed.

The departure from a line at right angles with the channel is so slight (only 14 degrees) that I do not consider it a matter of much consequence; yet, in an engineering point of view, it would doubtless be better not to make any departure at all. If it be built on the inclined line there will be a slightly increased chance of deposits below the southern (or island) half of the bridge, but should such occur they will be in a locality which has never been used for general navigation, because such channel as exists there is too crooked for safe navigation, whilst the other channels are perfectly safe and easy.

The difference in cost between a bridge located as proposed and one built on the other line would be something against the latter, and its southern (or island) terminus would be less convenient. The effect of a bridge on the proposed line in prolongation of a fine street, such as it is expected the boulevard will be, would certainly be more impressive and pleasing to the eye than if built with a change of direction, a fact which should be taken into account in this connection.

Upon the whole, all questions considered, I think the arguments in favor of building the bridge on the proposed line outweigh those in favor of a line at right angles with the channel, and am of opinion that so located and constructed it will not unreasonably obstruct the channel of the river. I therefore recommend that the proposed location be approved.

2. *Spans.*—The second section of the act requires that the draw or pivot span shall be so constructed as to leave a clear opening of not less than 125 feet on each side of the pivot pier, and that the pivot pier shall be located over the channel of Detroit River in such manner that one or both of the openings of said draw or pivot span can be conveniently and safely reached and passed by boats navigating the ordinary channel.

The pivot span proposed is 318 feet long, with a clear opening of 125 feet on *each* side of a pivot pier, located in the main channel in such manner that it may be conveniently reached and passed on either side of said pivot pier. The requirements of the act are therefore complied with in these respects.

The act does not prescribe the length to be given the fixed spans. The specifications and drawings of the proposed bridge indicate 11 metal spans, measuring 156 feet each from centers of masonry.

This length of span gives a clear water-way of about 149 feet between adjacent masonry piers, and, in my opinion, is sufficient. The spans might have been designed for a sufficient width to have rendered necessary at least one pier less, probably at no considerably greater cost, and I think it would have been better, but do not raise this point as a serious objection to the span proposed.

3. *Approaches.*—The plans and specifications show approaches of timber pile-work, the northern one (next the city) being 497 feet long, and the other being 600 feet. Although in these localities the action of ice is much less destructive than in the channel, yet it is likely to be sufficiently so to render their early reconstruction necessary. However, as proposed they are not likely to injuriously affect the channel, and may be approved.

4. *Height at which the bridge shall be constructed.*—Section 3 of the act provides "that the height at which said bridge shall be constructed above the surface of the river shall be such as may be approved by the Secretary of War."

The specifications place the top of the bridge floor at a height of 22 feet above ordinary water level. This fixes the top of the piers at a height of 20 feet above the same level.

The variation in the water level of Detroit River is comparatively slight, seldom amounting in any one year to as much as 2 feet. In a long series of years it might amount to as much as 6 feet, that is to say, 3 feet above or below mean level, consequently the height seems to be sufficient for all practical purposes.

5. *Operating draw-span.*—Section 4 of the act requires that all draw or pivot spans shall be operated by steam or other reliable mechanical power. The plans and specifications provide for steam-power, with alternative hand-power. The whole arrangement is well designed, and in my opinion may be approved.

6. *Position of piers with reference to current.*—It is required by section 5 of the act that the "piers upon which said bridge is built shall be parallel with the current of the river."

The specifications appear to be silent as to the direction which the piers shall occupy with reference to the current, but refer to the drawings which accompany and form part of the specifications. (Item 13, page 2.) The drawings show all piers, abutments, and trestles parallel to the current, thus making the bridge askew with reference to them. This seems to be sufficient to secure the proper position for these portions of the structure. However, lest there should be misunderstanding upon the subject, I desire to say that in recommending approval of the location of the bridge I do so under the express condition that all constructions extending below the surface of the water shall be placed parallel with the thread of the current.

Inasmuch as the specifications and drawings show that this is the intention they may be approved in this regard.

7. *Plans.*—The drawings are sufficiently in detail to show the proposed location of the bridge and the general features of its construction. The strain sheets show the stresses to which the various parts of the bridge will be subjected, and these have been recomputed in this office.

The details of construction are not given, at least so far as concerns the superstructure, but the specifications seem to provide all that is necessary to secure a proper construction. However, detail sheets should be prepared after the contract is awarded to the end that there be no serious departure from the general design, and particularly in the areas of cross-section and arrangement of parts entering into them, as well as the relations of the parts going to make up the trusses.

It is proposed to found the masonry upon a timber grillage 6 feet in thickness, resting upon piles cut off at a depth below the surface of the water, generally of 16 feet, the spaces between and about the piles being compactly filled with riprap before they are cut off. This is the most objectionable feature of the whole design, and unless the work be done with absolute fidelity the results might be serious. The additional cost involved in founding the masonry at a considerably greater depth is so great that it is doubtful if the amount of funds available would suffice to construct the bridge, and if it be required that this additional depth be attained the condition may prevent its early construction.

The prevalent desire upon the part of the people of the city of Detroit that the bridge be built as soon as possible is so great that I am reluctant to interpose such a condition. However, it is a design I would not personally propose, and I therefore find myself unable to recommend that it be specifically approved. If the city can nevertheless be permitted to proceed with the work, under the consideration that it is the money of the city and not that of the Government that is involved, and that it is the city of Detroit and not the United States which takes all the chances, then the proposed foundation may be approved. I do not mean to assert that the foundations if built as proposed would be sure to fail, or even that the chances are largely against their success, but I do not think they are designed with sufficient assurance of stability to justify me in making a specific recommendation that they be approved, although if faithfully built as designed I think the chances are that they would prove to be sufficient.

8. *Specifications.*—The specifications are general in their nature, but seem to be sufficient, if faithfully observed, to provide for all contingencies.

9. *Data.*—Section 8 of the act provides that before commencing work on the bridge certain data shall be submitted by the municipal authorities to the Secretary of War. These appear to have been furnished, and include—

A design and drawing of the proposed bridge and piers.

A map of the location, giving for the space of one-half mile on each side of the proposed location the topography of the banks of the river, the shore-line (which because of the freedom from freshets is always practically the same), the direction of the current in the navigable channel, and the soundings.

A cross-section of the stream along the line of the proposed location.

In addition to the foregoing, there is supplied from this office an extract from the published lake survey chart of Detroit River upon which is indicated in red the line of the prosposed bridge.

10. *Finally.*—I have been in great doubt as to the amount of detail desired in this report, as well as concerning the character of the approval required by the act. Is it to be limited to the location of the bridge, the draw-span, its length, and mode of operating it; the height of the bridge above the surface of the river, and the location of the piers in their relation to the current, but without reference to any of the details of construction? Or is it to be more specific, and apply as well to all the details of construction? It seems to me that the law only contemplates the former, and with that understanding I recommend approval, leaving to the city of Detroit all responsibility for the details of construction.

The papers referred to me are herewith respectfully returned.

All of which is respectfully submitted.

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen. U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., June 17, 1887.

SIR: Acknowledging the receipt of the papers in the case of the bridge proposed to be built by the city of Detroit under the provisions of "An act to provide for the construction of a bridge across the west channel of the Detroit River to connect Belle Isle Park with the mainland," approved July 20, 1886, which were returned to this office with approval of plans, etc., by the Acting Secretary of War, dated June 14, 1887, I beg leave to recommend that under provisions of section 10 of the act above mentioned Lieut. Col. O. M. Poe, Corps of Engineers, be appointed by the Secretary of War to supervise and personally examine the construction of said bridge.

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Acting Chief of Engineers.

HON. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

WAR DEPARTMENT, *June* 18, 1887.

Approved.

By order of the Acting Secretary of War:

JOHN TWEEDALE,
Chief Clerk.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., June 23, 1887.

SIR: By direction of the Secretary of War, you are hereby appointed, under the provisions of section 10 of "An act to provide for the construction of a bridge across the west channel of the Detroit River to connect Belle Isle Park with the mainland," approved July 20, 1886, "to supervise and personally examine the construction of said bridge." The inclosed copy of a letter from the Acting Chief of Engineers to the Acting Secretary of War, dated 17th instant, with approval indorsed thereon, is furnished for your information and guidance.

You are requested to call upon the city authorities of Detroit for a copy of the approved plan and location of the bridge.

By command of Brigadier-General Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. O. M. POE,
Corps of Engineers.

W W 10.

INTERNATIONAL BRIDGE OF THE SAULT STE. MARIE BRIDGE COMPANY ACROSS SAINTE MARIE RIVER, AUTHORIZED BY ACT OF CONGRESS APPROVED JULY 8, 1882.

DETROIT, MACKINAC AND MARQUETTE RAILROAD COMPANY,
PRESIDENT'S OFFICE,
Detroit, Mich., March 8, 1887.

DEAR SIR: Messrs. Strong and Peterson, representing our Sault Ste. Marie Bridge Company, go to Washington to lay before you the plans which have been made by Mr. Peterson, our chief engineer, for the building of the international bridge over the Sault River, in accordance with the act of Congress, viz:

PUBLIC—No. 155.

An act to authorize the construction of a railroad bridge across the Sainte Marie River.
Approved July 8, 1882.

Under that act the plans of the bridge have to be submitted to you for your approval.

Will you kindly give the matter your attention, so that we may proceed with the building of the bridge without delay, and oblige,

Yours, very respectfully,

JAMES MCMILLAN,
President The Sault Ste. Marie Bridge Company.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE OF CHIEF OF ENGINEERS,
U. S. ARMY,
March 15, 1887.

Respectfully referred to Lieut. Col. O. M. Poe, Corps of Engineers, for examination and early report.

The act authorizing the bridge may be found on pages 369–370 of Annual Report of the Chief of Engineers for 1882.

By command of Brigadier-General Duane.

JOHN G. PARKE,
Colonel of Engineers,
Brt. Maj. Gen., U. S. A.

[Second indorsement.]

UNITED STATES ENGINEER OFFICE,
Detroit, March 21, 1887.

Respectfully returned to the office of the Chief of Engineers, with written report of this date.

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
March 26, 1887.

Respectfully returned to the Secretary of War with report of Lieut. Col. O. M. Poe, Corps of Engineers, to which attention is invited.

It is suggested that the bridge authorities be furnished with copy of Colonel Poe's report, and that they be requested to comply with the suggestions contained therein.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS, ACCOMPANYING SECOND INDORSEMENT ON FOREGOING COMMUNICATION.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., March 21, 1887.

SIR: In compliance with indorsement dated Office Chief of Engineers, U. S. Army, March 15, 1887, upon communication of March 8, 1887, addressed by Mr. James McMillan, president of the Sault Ste. Marie Bridge Company to the Secretary of War, submitting "plans which have been made * * * for the building of the international bridge over the Sault River, in accordance with the act of Congress," viz:

PUBLIC—No. 155.

An act to authorize the construction of a railroad bridge across the Sainte Marie River.

Approved July 8, 1882.

I have the honor to submit the following report, viz:

(1) The act referred to does not become operative until "due authority shall have been given to any person or corporation by the Dominion of Canada, with the sanction of the British Government, to build or join in the building of a bridge for such purpose, to build a bridge across the Sainte Marie River, at or near the rapids in said river."

The papers referred to me contain no evidence of the required authorization. It is possible that this point is not included amongst those upon which a report is expected from me, and it is only mentioned in order to make the report as full as possible.

(2) The second section of the act provides that "it shall be the duty of said Sault Sainte Marie Bridge Company before entering upon the construction of said bridge to submit to the Secretary of War, for his approval, a drawing and description, fully showing the plan and location proposed for said bridge."

The papers referred to me are sufficient to show the proposed location of the bridge, but they can not be considered as "fully showing the plan." In fact, the printed specifications indicate that the plan has not yet been determined, but is left to the successful bidder for the work, subject to certain conditions therein specified.

The location indicated is near the point that has always been deemed the least objectionable for the railroad crossing, and in my opinion may be accepted. It crosses one corner of the area on the south side of the canal set apart for light-house purposes, but does not interfere with the building already erected. The canal grounds are crossed obliquely, thus requiring a larger and heavier draw-bridge. The rapids are crossed some distance below any part of the river now used for purposes of navigation.

The plans of the superstructure are not given. For the portion of the bridge outside the limits of the canal grounds the specifications may perhaps be considered a sufficient compliance with the provisions of section 2 of the act, but since the portion over the canal is to be operated under the supervision of the Secretary of War (sec. 3 of the act), complete plans, with strain sheets and method of revolving the draw-bridge, should be submitted. In this connection I may remark that, in my opinion, ample steam-power should be used for opening and closing the draw-bridge during the season of navigation, to the end that the least possible delay and inconvenience shall be caused. The bridge company appear to have the right of way over the canal grounds for the length of the draw-bridge when standing at right angles with the direction of the crossing, that is to say, for a width of about 416 feet in the direction of the canal, with the proviso "that the rights of navigation and of private parties be in all cases respected" (sec. 5 of the act). This will be likely to give rise to questions such as the right of the bridge company to use the canal pier within this limit for the purpose of landing materials. This seems to be a favorable time to interpret the law, before any questions occur. The location of the crossing being at the narrow part of the canal, where crowding of vessels, resulting in "jams," is not at all unusual, it would seem that the bridge company ought not to have the right to further increase the difficulty by devoting any portion of it to the purpose of unloading vessels. It is possible that the present regulations for the government of the canal are sufficient to prevent such an objectionable course upon the part of the bridge company, but the matter should be determined, with all the authority of the Secretary of War, prior to beginning the construction of the bridge, thus avoiding collisions between the navigation interests, supported by the canal authorities on one side and the bridge company (or their contractors) on the other.

In conclusion, I recommend that the proposed location of the crossing, as shown by the papers referred to me, be approved, but that approval of the plans be deferred until the requirement of section 2 of the act be complied with, by submitting full plans and strain sheets of that portion of the bridge over the canal, together with a method of operating the draw-bridge with ample steam-power.

The papers referred to me (one letter, one printed specifications, and three tracings) are herewith respectfully returned.

Very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

To the CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., April 1, 1887.

SIR: Referring to your letter to the Secretary of War dated March 8, 1887, requesting approval of the plans for the proposed bridge over Ste. Marie River, submitted in accordance with the provisions of the act of July 8, 1882, I am directed to inform you that the papers were referred to Lieut. Col. O. M. Poe, Corps of Engineers, for examination, and have been returned, with a report dated March 21, 1887, a copy of which is, by authority of the Secretary of War, transmitted for your information, with request that the suggestions contained therein be complied with. The drawings, etc., are accordingly herewith returned.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

JAMES MCMILLAN, Esq.,
President Sault Ste. Marie Bridge Company.

LETTER OF THE PRESIDENT OF THE SAULT STE. MARIE BRIDGE COMPANY.

THE SAULT STE. MARIE BRIDGE COMPANY,
PRESIDENT'S OFFICE,
Detroit, Mich., April 22, 1887.

SIR: Referring to my letter to you of March 8 ultimo, requesting approval of the location and plans for the proposed bridge over the Sault Ste. Marie River, and to General Poe's report to General Duane, dated March 21, and to General Duane's letter to me of April 1, I find that it may occupy our engineers engaged in making the detailed plans of the bridge from ten days to two weeks longer to complete them. We will then submit the same to your Department without delay. In the mean time it would be of great assistance in facilitating our preliminary arrangements for construction (which for such works are exceedingly extensive and various) if the Department would formally approve of the location of the crossing as recommended in the latter part of General Poe's report, as follows:

"In conclusion, I recommend," etc.

Respectfully urging your compliance with this suggestion, I am, your obedient servant,

JAMES MCMILLAN,
President The Sault Ste. Marie Bridge Company.

HON. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 28, 1887.

Respectfully referred to Lieut. Col. O. M. Poe, Corps of Engineers, for report.

To be returned.

By command of Brig. Gen. Duane:

CHAS. W. RAYMOND,
Major of Engineers.

[Second indorsement.]

U. S. ENGINEER OFFICE,
Detroit, Mich., May 2, 1887.

Respectfully returned to the office of the Chief of Engineers, accompanied by a written report of even date.

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 7, 1887.

Respectfully returned to the Secretary of War, inviting attention to the accompanying report of Lieut. Col. O. M. Poe, Corps of Engineers, dated the 2d instant. It will be seen that Colonel Poe recommends approval of the proposed location of the bridge, but calls attention to the provisions of the act of July 8, 1882, authorizing construction "whenever due authority shall have been given to any person or corporation by the Dominion of Canada, with the sanction of the British Government, to build or join in the building of a bridge for such purpose, to build a bridge across the Ste. Marie River at or near the rapids in said river," etc., which provision, so far as is shown by the papers submitted, has not been complied with.

It is accordingly recommended that the attention of the bridge authorities be called to the subject, and that they be required to file with their application for constructing the bridge, in duplicate, the necessary evidence, duly authenticated, showing that the authority of the "Dominion of Canada, with the sanction of the British Government to build or join in the building of a bridge," etc., has been obtained.

It is also suggested that the bridge authorities be furnished with a copy of Colonel Poe's report.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS, ACCOMPANYING SECOND INDORSEMENT ON FOREGOING COMMUNICATION.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., May 2, 1887.

SIR: In compliance with indorsement dated "Office of the Chief of Engineers, April 28, 1887," on a letter dated April 22, 1887, from James McMillan, esq., president Sault Ste. Marie Bridge Company, to the Secretary of War, requesting approval of location proposed for a bridge across St. Mary's Falls Canal and Sault Ste. Marie River, I have the honor to submit the following report, viz:

In my report of the 21st of March, 1887, I recommended approval of the proposed location, and I respectfully renew that recommendation.

I infer that the urgency of the bridge company in this case arises from a desire to land materials, etc., and make certain preparations at St. Mary's Falls Canal in advance of the formal approval of plans and specifications.

The company, through their chief engineer, P. Alex. Peterson, esq., applied to me, under date of April 14, 1887, for permission to use a portion of the northwestern canal pier as a landing-place for materials required in the construction of the substructure of the bridge. (See copy herewith marked A.)

Under date of April 16, 1887, Mr. Peterson was informed that I had not received official information that the Secretary of War has approved the location of the bridge, or that he had sanctioned beginning the work of construction, and, under the circumstances, declined to act in the matter. (See copy herewith marked B.)

In this connection I beg leave to invite attention to the following provisions of the act of Congress approved July 8, 1882, authorizing the construction of the bridge in question, viz:

> *Be it enacted, etc.,* That it shall be lawful for the Sault Sainte Marie Bridge Company, a corporation duly organized by and under the laws of the State of Michigan, whenever due authority shall have been given to any person or corporation by the Dominion of Canada, with the sanction of the British Government, to build or join in the building of a bridge for such purpose, to build a bridge across the Sainte Marie River, at or near the rapids in said river, etc.

From the foregoing it is plain that certain action "by the Dominion of Canada, with the sanction of the British Government," is necessary before the act of Congress becomes operative, and that any authorization to begin work upon the bridge prior to the fulfillment of the conditions precedent would be illegal.

I have not received any information as to whether the requisite steps in the matter have been taken, and must therefore limit myself to simply inviting attention to the important conditions imposed by the act of Congress.

In case the Secretary of War formally approves the proposed location of the bridge, I request that I be officially informed of the fact, and also whether such approval carries with it permission for the bridge company to enter upon the canal grounds and begin the work of construction, either in the necessary preparations (such as landing material, plant, etc.), or in the more advanced stages.

I am, sir, very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, May 14, 1887.

SIR: In connection with previous correspondence on the subject of the location and plans for the proposed bridge to be constructed by the

Sault Sainte Marie Bridge Company, over the Sault Sainte Marie River, the Department is in receipt of your letter of the 22d ultimo, requesting my approval of the location of the crossing, pending the completion of detailed plans of the proposed bridge.

In reply I beg to inclose a copy of a report of the 2d instant on the subject with its inclosures, from Lieut. Col. O. M. Poe, Corps of Engineers, who recommends approval of the location in question, but invites attention to the provisions of the act of July 8, 1882, which authorize the construction of the bridge "whenever due authority shall have been given to any person or corporation by the Dominion of Canada, with the sanction of the British Government, to build or join in the building of a bridge for such purpose, to build a bridge across the Sainte Marie River, at or near the rapids in said river," etc.

In will be seen that any authorization to begin work upon the bridge prior to the fulfillment of the conditions imposed would be inoperative, and I therefore beg to request that you will furnish this Department with the necessary evidence, in duplicate, duly authenticated, showing that the authority of the "Dominion of Canada, with the sanction of the British Government, to build or join in the building of a bridge," etc., has been obtained.

Upon receipt of the information above indicated, the matter will receive the prompt action of the Department.

Very respectfully,

WILLIAM C. ENDICOTT,
Secretary of War.

JAMES MCMILLAN, Esq.,
President Sault Ste. Marie Bridge Company,
Detroit, Mich.

LETTER OF THE PRESIDENT OF THE SAULT STE. MARIE BRIDGE COMPANY.

THE SAULT STE. MARIE BRIDGE COMPANY,
PRESIDENT'S OFFICE,
Detroit, Mich., May 17, 1887.

DEAR SIR: I am in receipt of your letter of 14th instant, $\frac{1836}{\text{A}}$, inclosing copies of letters from General Poe in regard to the provision of the the act of July 8, 1882, which reads:

> Whenever due authority shall have been given to any person or corporation by the Dominion of Canada, with the sanction of the British Government, to build or join in the building of a bridge for such purpose, to build a bridge across the Sainte Marie River at or near the rapids in said river, etc.

In reply I beg to say that I am informed that the charter of the Sault Ste. Marie Bridge Company of Canada might have been disallowed by the British Government any time within two years after its passage by the Canadian Parliament. When a bill is sanctioned by the Canadian Governor and is not vetoed or disallowed by the Imperial Government, it is considered as sanctioned by the British Government. All legislation in Canada is with the sanction of the British Government. No formal sanction of each bill is required.

A copy of the Canadian act sanctioning the building of this bridge has been sealed and signed by the secretary of state of Canada and forwarded the Department.

I trust the requirements of the Department have now been fully complied with.

Very respectfully,

JAMES MCMILLAN,
President.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, June 28, 1887.

SIR: I have the honor to inclose, for retention by the Sault Sainte Marie Bridge Company, a duly executed copy of the instrument approving the location of the bridge authorized to be constructed by the company across the Sainte Marie River, at or near its rapids in Chippewa County, Michigan, under the provisions of an act of Congress approved July 8, 1882.

Very respectfully, your obedient servant,

WILLIAM C. ENDICOTT,
Secretary of War.

JAMES MCMILLAN, Esq.,
President Sault Sainte Marie Bridge Company,
Detroit, Mich.

LETTER OF THE PRESIDENT OF THE SAULT SAINTE MARIE BRIDGE COMPANY.

THE SAULT SAINTE MARIE BRIDGE COMPANY,
PRESIDENT'S OFFICE,
Detroit, Mich., July 2, 1887.

DEAR SIR: I have the honor to acknowledge receipt of your letter of 28th June, inclosing a duly executed copy of the instrument approving the location of the Sault Sainte Marie Bridge Company's bridge by the War Department.

I beg to express my thanks to the Department for the satisfactory manner in which this matter has been brought to a conclusion.

Very respectfully,

JAMES MCMILLAN,
President.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., July 2, 1887.

SIR: The Secretary of War has approved the plan and location submitted by "The Sault Sainte Marie Bridge Company" for the bridge provided for by "An act to authorize the construction of a railroad

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 15, 1887.

Respectfully returned to the Secretary of War, through the Acting Judge-Advocate General, U. S. Army.

The papers as now presented are believed to fulfill the requirements of the case, and are recommended for approval.

CHAS. W. RAYMOND,
Acting Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE GENERAL'S OFFICE,
Washington, D. C., June 16, 1887.

Respectfully returned to the Secretary of War, with instrument of approval by the Secretary of War, of the plan and design of the bridge, and map of location, submitted by the Nebraska Railway Company, prepared in duplicate.

G. NORMAN LEIBER,
Acting Judge-Advocate General.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., July 9, 1887.

SIR: The Secretary of War has approved the plan and location submitted by the Nebraska Railway Company for the bridge provided for by "An act authorizing the construction of a bridge across the Missouri River, opposite to or within the corporate limits of Nebraska City, Nebraska," approved June 4, 1872, "subject to the condition, however, that the engineer officer of the United States Army in charge of the district within which the bridge is to be erected, may supervise its construction, so far as may be necessary, in order that the plans approved by the Secretary of War shall be complied with and the bridge built accordingly." It is desired, therefore, that you exercise the requisite supervision with a view to compliance with the directions of the Secretary of War.

The inclosed blue prints, showing approved plan and location of the bridge, are transmitted for your information.

By command of Brig. Gen. Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. C. R. SUTER,
Corps of Engineers.

W W 12.

COMBINED RAILWAY AND WAGON BRIDGE OF THE OMAHA AND COUNCIL BLUFFS RAILWAY AND BRIDGE COMPANY, ACROSS MISSOURI RIVER BETWEEN OMAHA, NEBRASKA, AND COUNCIL BLUFFS, IOWA, AUTHORIZED BY ACT OF CONGRESS APPROVED MARCH 3, 1887.

WAR DEPARTMENT,
Washington City, June 3, 1887.

SIR: Referring to your letter of April 11, submitting plans for the proposed bridge across the Missouri between Omaha and Council Bluffs, under the act approved March 3, 1887, I have the honor to inform you that Mr. Endicott, Secretary of War, has taken the opinion of the Attorney-General in regard to the kind of bridge that is required by the act. The opinion of the Attorney-General, which agrees with the views of the Secretary of War, is that—

> It was the evident intention of Congress that the bridge should be maintained as much for the transit of railway trains as for any other kind of carriages or cars upon paying lawful tolls.
>
> To allow a bridge to be built not adapted for the use of railway companies entitled to use it, would be to defeat the obvious intention of Congress.

The plans presented by you are for a highway bridge and can not therefore be approved.

Very respectfully, your obedient servant,

S. V. BENÉT,
Brig. Gen., Chief of Ordnance
and Acting Secretary of War.

Mr. JOHN T. STEWART,
President Omaha and Council Bluffs Railway and
Bridge Company, Omaha, Nebraska.

OPINION OF THE ATTORNEY-GENERAL OF THE UNITED STATES.

DEPARTMENT OF JUSTICE,
Washington, June 2, 1887.

SIR: An opinion is asked on the point whether the plans for the bridge authorized by the act approved March 3, 1887, entitled "An act authorizing the construction of a bridge across the Missouri River between the cities of Omaha, Nebraska, and Council Bluffs, Iowa, and for other purposes," can be properly approved by the Secretary of War unless they provide for a structure of strength sufficient to bear trains of cars drawn by locomotives.

It seems clearly the intention of Congress that the bridge provided for shall be built in such a way as to accommodate all sorts of land-carriage and traffic.

> A combined railway and wagon bridge, for the safe and convenient passage of wagons, carriages, stock, *steam*, cable, and street cars, foot-passengers, and all road travel.

It was the evident intention of Congress that the bridge should be maintained as much for the transit of railway trains as for any other kind of carriages or cars upon paying the lawful tolls.

(2) That should any change be made in the plan of said bridge during the progress of the work thereon, such change shall be subject to the approval of the Secretary of War.

(3) That the engineer officer of the United States Army in charge of the district within which the bridge is to be erected may supervise its construction so far as may be necessary in order that the plans approved by the Secretary of War may be complied with and the bridge built accordingly.

It is desired, therefore, that you exercise the requisite supervision with a view to compliance with the directions of the Secretary of War.

Copies of the approved plans, etc., will be furnished you as soon as practicable.

By command of Brigadier-General Duane:

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. C. R. SUTER,
Corps of Engineers.

W W 13.

BRIDGE OF THE NEW YORK AND LONG ISLAND BRIDGE COMPANY ACROSS THE EAST RIVER BETWEEN THE CITY OF NEW YORK AND LONG ISLAND, AUTHORIZED BY ACT OF CONGRESS APPROVED MARCH 3, 1887.

NEW YORK, *July* 29, 1887.

SIR: The New York and Long Island Bridge Company respectfully applies for the approval of the Secretary of War of their plans for a bridge across the East River between New York City and Long Island, which plans are herewith submitted in duplicate. A copy of the act of incorporation or charter of the company, passed by the legislature of the State of New York in the year 1867, and the several acts amendatory thereto, as well as the act of Congress (Chapter 334, Laws of 1886 and 1887), are also herewith submitted.

Under these acts this company was incorporated, and a copy of the minutes of the organization of the company is also herewith submitted; also extracts from the company's, minutes, showing the names of the present officers of the company and the acceptance by the company of the provisions of the act of Congress, all properly authenticated.

Very respectfully,

C. A. TROWBRIDGE,
President of the New York and Long Island Bridge Company.
R. MCGRAHAM,
Secretary.

Hon. SECRETARY OF WAR.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 8, 1887.

Respectfully returned to the Secretary of War. The only plans and drawings for the bridge in question received at this office were transmitted by Mr. Thomas Rainey December 14, 1886, before the act authorizing the bridge was passed by Congress. These are presumed to be the plans referred to within, and they are submitted herewith.

The act of March 3, 1887, providing for the bridge, requires that it "shall be constructed at right angles with the channels of said river, the piers or abutments to be constructed on the land side of the harbor or pier lines established by law; such bridge shall be not less than 150 feet elevation above mean high water at the middle of each channel of the river, and no part of the lower chord of the channel span less than 142 feet above mean high water."

The plans are too indefinite to indicate clearly that the above requirements have been complied with. Neither does the map comply with the requirements of section 4 of the act for "a detailed map of the river at the proposed site of the bridge and for the distance of a mile above and below the site, exhibiting the depths at low and high tide and currents at all points of the same," etc.

The drawings should also be furnished in duplicate.

It is therefore suggested that they be returned to the bridge authorities, with request that the omissions be supplied and that duplicates be submitted.

CHAS. W. RAYMOND,
Acting Chief of Engineers.

[Second indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
August 24, 1887.

Respectfully returned to the Secretary of War through the Acting Judge-Advocate-General, U. S. Army.

The accompanying drawings, in duplicate, showing plan and location of the proposed bridge of the New York and Long Island Bridge Company, are in accordance with the requirements of the "act authorizing the construction of a bridge across the East River between the city of New York and Long Island," approved March 3, 1887, and are recommended for approval.

CHAS. W. RAYMOND,
Acting Chief of Engineers.

[Third indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., August 27, 1887.

Respectfully returned to the Secretary of War, with draught of instrument (in duplicate), for formal approval by the Secretary of War of the plan and map of location of the within-mentioned bridge.

Attention is invited to the fact that the accompanying articles of incorporation are not authenticated by the seal of the secretary of state of the State within which the bridge is located.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, August 29, 1887.

SIR: I have the honor to inclose an instrument, in duplicate, indicating approval by this Department of the plans and location, as shown on the accompanying tracings, of a bridge authorized to be constructed by the New York and Long Island Bridge Company across the East

River, between the city of New York and Long Island, under the provisions of an act of Congress approved March 3, 1887.

Please have these papers properly executed by the company and returned to the Department for completion.

I inclose also a copy of the articles of incorporation of your company, furnished in compliance with the rule of this Department of July 31, 1886, with request that the same be properly authenticated under the seal of the secretary of state of the State of New York, and returned to the Department.

Very respectfully, your obedient servant,

R. MACFEELY,
Acting Secretary of War.

C. A. TROWBRIDGE, Esq.,
President New York and Long Island
Bridge Company, New York, N. Y.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., October 6, 1887.

SIR: The Secretary of War has approved the plan and location of the bridge authorized by "an act authorizing the construction of a bridge across the East River between the city of New York and Long Island," approved March 3, 1887, "subject to the condition, however, that the engineer officer of the United States Army in charge of the district within which the bridge is to be erected may supervise its construction, so far as may be necessary, in order that the plans approved by the Secretary of War shall be complied with and the bridge built accordingly."

It is accordingly desired that you exercise the requisite supervision over the construction of the bridge, with a view to compliance with the directions of the Secretary of War.

A copy of the approved plan, etc., will be furnished you as soon as practicable.

By command of Brigadier-General Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. WALTER MCFARLAND,
Corps of Engineers.

W W 14.

BRIDGE OF THE OHIO VALLEY RAILWAY COMPANY ACROSS THE TRADEWATER RIVER, KENTUCKY, AUTHORIZED BY ACT OF CONGRESS APPROVED FEBRUARY 21, 1887.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., September 26, 1887.

SIR: The act of Congress approved February 21, 1887, provides for the construction of a bridge across the Tradewater River by the Ohio Valley Railway Company. Section 4 of the act states:

> That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said

river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War for his examination and approval a design and drawing of the bridge and a map of the location thereof, and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built.

It having come to the knowledge of this office that the Ohio Valley Railway Company were constructing this bridge without submitting the plan and map of its location for approval, the attention of Major Stickney, Corps of Engineers, the officer in charge of the district including the Tradewater River, was called to the fact, and he was directed to submit a report concerning it. The bridge crosses the river obliquely about 200 yards below Black Ford, making with it an angle of 10 to 12 degrees. It is provided with a draw-span having a clear opening of 70 feet, or 62 feet perpendicular to the direction of the river. At the time of the inspection in July last the construction of the piers was in progress.

The plan of the bridge and a map of the location, both in duplicate, are now submitted by the company for approval, together with the papers required by the rule of the Secretary of War dated July 31, 1886.

Major Stickney reports that the bridge when finished as proposed will present no material obstruction to navigation. He, however, recommends, if the plan and location of the bridge be approved, that the false or trestle work used in its construction be required to be removed by December 1 next, and that the approval contain the special condition that the railway company shall erect, at their own expense, such additional structures or aids to navigation as, in the opinion of the Secretary of War, may be found necessary for the safe passage of the bridge at all stages of the river.

If the approval is made subject to the foregoing conditions, this office knows of no reason why it should not be granted.

Previous papers in the case are submitted herewith.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[Second indorsement.]

WAR DEPARTMENT, *September* 28, 1887.

Respectfully referred to the Acting Judge-Advocate-General to prepare the papers in duplicate for approval, subject to the conditions proposed by the Chief of Engineers.

By order of the Acting Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., October 3, 1887.

Respectfully returned to the Secretary of War, with instrument of approval, by the Secretary of War, of the plan and design of the bridge to be constructed across the Tradewater River, Kentucky, by the Ohio Valley Railway Company, and map of location prepared in duplicate as directed in the preceding indorsement.

Attention is respectfully invited to the incomplete condition of the map of location furnished. It gives no information whatever as to the point on Tradewater River, in the State of Kentucky, at which the bridge has been located. It is respectfully recommended that the map be completed before the instrument is approved.

J. W. CLOUS,
Acting Judge-Advocate-General.

[Fourth indorsement.]

WAR DEPARTMENT, *October* 27, 1887.

Respectfully returned to the Chief of Engineers, one copy of the within instrument having been sent on the 25th to the president of the Ohio Valley Railway Company.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., November 2, 1887.

SIR: The Secretary of War has approved the plan and location of the bridge across the Tradewater River, Kentucky, by the Ohio Valley Railway Company, authorized by the act approved February 21, 1887, upon the express conditions following:

(1) That the pile-trestle or false work over which the crossing is at present made shall be entirely removed on or before December 1, 1887.

(2) That the Ohio Valley Railway Company shall, at its own expense, erect and maintain such additional structures or aids to navigation as in the opinion of the Secretary of War may be necessary for a safe passage of the bridge at all stages of the river by vessels and rafts navigating said river.

(3) That the engineer officer of the United States Army in charge of the district within which the bridge is to be built may supervise its construction so far as may be necessary in order that the plans hereby approved shall be complied with, and the bridge built accordingly.

It is accordingly desired that you exercise the requisite supervision over the construction of the bridge in order that the directions of the Secretary of War be complied with.

Copies of the approved plan, etc., will be furnished you as soon as practicable.

By command of Brig. Gen. Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Maj. AMOS STICKNEY,
Corps of Engineers.

W W 15.

BRIDGE OF THE SIOUX CITY BRIDGE COMPANY ACROSS THE MISSOURI RIVER AT SIOUX CITY, IOWA, AUTHORIZED BY ACT OF CONGRESS APPROVED AUGUST 15, 1876.

NEW YORK, *April* 14, 1887.

DEAR SIR: I herewith submit for your examination and approval the plans of a proposed bridge across the Missouri River at Sioux

City, Iowa, to be built by the Sioux City Bridge Company, under authority granted by an act of Congress approved August 15, 1876.

I am, very respectfully, yours,

GEO. S. MORISON,
Chief Engineer Sioux City Bridge.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

P. S.—Accompanying this letter are the following papers:

(1) A copy of the articles of incorporation of the Sioux City Bridge Company, certified by the secretary of state of the State of Iowa, with the certificate of the recorder of Woodbury County.

(2) Extracts from records of meetings of the board of directors of the Sioux City Bridge Company, showing organization January 1, 1873, by election of officers. January 1, 1874, authority given the president to apply for an act of Congress authorizing the construction of the bridge; December 5, 1887, acceptance of act of Congress; these extracts being certified by the secretary of the Sioux City Bridge Company.

(3) Copy of minutes of stockholders' meeting held June 7, 1886, certified by the secretary of the Sioux City Bridge Company.

(4) Extracts from minutes of directors' meetings held June 7, 1886, and March 12, 1887, showing election of present officers. Certified by secretary of Sioux City Bridge Company.

(5) Extracts from directors' meeting held March 12, 1887, showing authority given officers to execute necessary agreements with the Government. Certified by the secretary of the Sioux City Bridge Company.

(6) Extracts from record of directors' meeting held March 24, 1887, adopting the plans of bridge. Certified by the Secretary of the Sioux City Bridge Company.

(7) Plans showing location of proposed bridge.

(8) Elevation and plan of proposed bridge.

Numbers 7 and 8 are in the form of triplicate blue-prints.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 23, 1887.

Respectfully referred to Lieut. Col. C. R. Suter, Corps of Engineers, president Missouri River Commission, for examination and report.

The act of Congress under which the bridge is authorized to be built may be found on page 146 of the Report of the Chief of Engineers for 1876.

To be returned.

By command of Brigadier-General Duane.

H. M. ADAMS,
Major of Engineers.

[Second indorsement.]

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., May 3, 1887.

Respectfully returned to the Chief of Engineers, United States Army, with report of this date

CHAS. R. SUTER,
Lieut. Col. of Engineers,
President Mo. River Commission.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 7, 1887.

Respectfully returned to the Secretary of War, through the acting Judge-Advocate-General, U. S. Army, inviting attention to the accompanying report of Lieut. Col. C. R. Suter, Corps of Engineers, president Missouri River Commission, from which it appears that the plans of the bridge have been examined by the Commission "and are considered by them to provide for an entirely satisfactory structure."

The proposed bridge is a high bridge "giving 50 feet clear headway at high water, with three 400-boat spans, two of which are now over the river and part of the third."

The act of August 15, 1876, provides for 300-foot spans only.

It is recommended that the plans submitted by the Sioux City Bridge Company be approved.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., May 10, 1887.

Respectfully returned to the Chief of Engineers, U. S. Army.

Section 3 of the act authorizing the construction of the bridge at or near Sioux City, Iowa (19 Stat., 206), requires that *specifications for its construction* shall be submitted to the Secretary of War, together with the location and plans thereof. Duplicate copies of these, certified by the secretary of the company, should therefore be furnished.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

[Fifth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 2, 1887.

Respectfully returned to the acting Judge-Advocate-General, U. S. Army, with letter of George S. Morison, chief engineer Sioux City Bridge, dated May 27, and accompanying papers, which furnish the information called for by the foregoing indorsement.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Sixth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., June 4, 1887.

Respectfully returned to the Secretary of War, with formal instrument for his approval (prepared in duplicate) of the location, plans, and specifications of the bridge across the Missouri River, near Sioux City, Iowa.

In the accompanying report of Colonel Suter it is said the bridge is to be built "with three 400-foot spans, *two of which are now over the river* and part of the third." Attention is therefore invited to the fact that the approval of the Secretary of War seems to have been anticipated by the Sioux City Bridge Company.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

REPORT OF LIEUTENANT-COLONEL CHARLES R. SUTER, CORPS OF ENGINEERS, PRESIDENT MISSOURI RIVER COMMISSION, ACCOMPANYING SECOND INDORSEMENT ON FOREGOING COMMUNICATION.

MISSOURI RIVER COMMISSION,
OFFICE OF THE PRESIDENT,
Saint Louis, Mo., May 3, 1887.

SIR: I have the honor to return herewith letter of George S. Morison, civil engineer, to the honorable Secretary of War, of April 14, 1887, covering plans of proposed bridge over the Missouri River at Sioux City, Iowa, and other documents, referred to me for report by your indorsement of April 23, 1887.

These plans have been examined by the Missouri River Commission, and are considered by them to provide for an entirely satisfactory structure. The bridge proposed is a high bridge giving 50 feet clear headway at high water, with three 400-foot spans, two of which are now over the river, and part of the third. I was informed by Mr. Morison that the bank here on the north or Iowa side is caving rapidly, and that it was the intention to let it cave back to the north pier, now on dry land, and then hold it. In any case, however, ample water way is afforded.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers,
President Missouri River Commission.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, June 6, 1887.

SIR: I have the honor to inclose an instrument, in duplicate, indicating approval by the Secretary of War, under certain specified conditions, of the design and location, as shown by the accompanying maps, of a bridge authorized to be erected by the Sioux City Bridge Company across the Missouri River at or near Sioux City, Iowa, under the provisions of an act of Congress approved August 15, 1876.

Please cause these papers to be properly executed and returned to the Department for completion.

Very respectfully,

WILLIAM C. ENDICOTT,
Secretary of War.

Mr. GEORGE S. MORISON,
Chief Engineer Sioux City Bridge Company,
35 *Wall Street, New York, N. Y.*

LETTER OF THE ACTING SECRETARY OF WAR.

WAR DEPARTMENT,
Washington, D. C., June 14, 1887.

SIR: I have the honor to inclose for retention by the Sioux City Bridge Company a duly-executed copy of an instrument expressing approval by the Department of the location and plans of the bridge authorized to be constructed by said company over the Missouri River at Sioux City, Iowa, under the provisions of an act of Congress approved August 15, 1876.

Very respectfully, your obedient servant,

S. V. BENÉT,
Brig. Gen., Chief of Ordnance,
and Acting Secretary of War.

E. L. CORTHELL, Esq.,
Engineer Sioux City Bridge Company.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., June 25, 1887.

SIR: The Secretary of War has approved the plan and location submitted by the Sioux City Bridge Company for their proposed bridge across the Missouri River at or near Sioux City, Iowa, as provided for by the act of Congress approved August 15, 1876, and, with the view to ascertaining that the plans approved by him are properly carried out, desires that you exercise such supervision over the bridge during its construction as may be necessary to that end.

The inclosed blue prints, showing approved plan and location of the bridge, are transmitted for your information.

By command of Brigadier-General Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. C. R. SUTER,
Corps of Engineers.

LETTER OF THE PRESIDENT OF THE SIOUX CITY BRIDGE COMPANY.

CHICAGO AND NORTHWESTERN RAILWAY COMPANY,
OFFICE OF PRESIDENT,
Chicago, February 24, 1888.

SIR: The Sioux City Bridge Company desires your approval of a modified plan of the bridge it is now building over the Missouri River at Sioux City, Iowa.

The modification of the plan consists in increasing its length by adding one 400-foot span to the west end of the bridge. The object of such modification is to give greater water-way, and thus to create a less disturbance in the regimen of the river than the original plan would have caused.

Mr. E. L. Corthell, of the firm of Morison & Corthell, chief engineers of the bridge, is authorized to personally present this letter and the modified plan.

Very respectfully,

MARVIN HUGHITT,
President Sioux City Bridge Company.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 29, 1888.

Respectfully returned to the Secretary of War. Upon careful comparison of the proposed modified plans with the *plans approved by the War Department* it is found that the latter provides for three spans, of 403 feet, 404.5 feet, and 403 feet, while the modified plan proposes *four* spans of 402.9 feet (additional), 404½, 404½, 402.9 feet, and the omission of the screen-dike provided for in the approved plan. No objection is known to the proposed modifications, as they come within the provisions of the act of August 15, 1876, and it is therefore recommended that they be approved.

If approved by the Secretary of War, it is suggested that but one of each of the new drawings be returned to the bridge company.

The approved plans are herewith submitted.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *March* 1, 1888.

Respectfully referred to the Acting Judge-Advocate General, to prepare the formal approval in duplicate.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE GENERAL'S OFFICE,
Washington, D. C., March 2, 1888.

Respectfully returned to the Secretary of War, with formal approval of modified plans submitted by the Sioux City Bridge Company for construction of bridge over the Missouri River at Sioux City, Iowa, prepared in duplicate as directed in preceding indorsement.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER OF THE ACTING SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, March 8, 1888.

SIR: I have the honor to inclose, for retention by the Sioux City Bridge Company, a duly executed copy of an instrument expressing approval by the Department of the amended plans of the bridge authorized to be constructed by said company over the Missouri River at Sioux City, Iowa, under the provisions of an act of Congress approved August 15, 1876.

Very respectfully,

S. V. BENÉT,
*Brig. Gen., Chief of Ordnance
and Acting Secretary of War.*

Mr. E. L. CORTHELL,
35 *Wall Street, New York, N. Y.*

LETTER OF MR. E. L. CORTHELL.

[Morison & Corthell, consulting and constructing engineers.]

CHICAGO, *March* 12, 1888.

SIR: I have to acknowledge the receipt of yours of March 8, inclosing executed copy, for retention by the Sioux City Bridge Company, of an instrument expressing the approval of the War Department of the amended plans of the bridge.

Yours, respectfully,

E. L. CORTHELL.

Gen. S. V. BENÉT,
Acting Secretary of War.

W W 16.

HIGHWAY BRIDGE OF THE CENTRAL RAILWAY AND BRIDGE COMPANY OF NEWPORT, KENTUCKY, ACROSS THE OHIO RIVER BETWEEN CINCINNATI, OHIO, AND NEWPORT, KENTUCKY, AUTHORIZED BY ACTS OF CONGRESS APPROVED DECEMBER 17, 1872, AND FEBRUARY 14, 1883.

INDORSEMENTS ON WRAPPER INCLOSING DRAWINGS OF LOCATION, PLANS, ETC., OF THE PROPOSED BRIDGE.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 23, 1888.

Respectfully submitted to the Secretary of War.

The plans and maps of the proposed bridge of the Central Railway and Bridge Company, of Newport, Ky., having been left at this office by the president of the company, are found, upon examination, to comply with the requirements of "An act to authorize the construction of bridges across the Ohio River and to prescribe the dimensions of the same," approved December 17, 1872, and "An act supplementary to an act approved December 17, 1872, entitled 'An act to authorize the construction of bridges across the Ohio River and prescribe the dimensions of the same,'" approved February 14, 1883 (copies herewith).

In order to comply with the provisions of sections 4 of the acts, I beg leave to recommend that the maps and drawings be referred to a Board of Engineers for examination and report, etc., as required by that section, and that it consist of the following officers of the Corps of Engineers:

Lieut. Col. O. M. Poe, and Majors Amos Stickney and Alexander Mackenzie, with Lieut. W. L. Sibert as recorder. The Board to meet at Cincinnati, Ohio, at as early a day as practicable, to make the examinations required by the sections of the acts referred to.

With the sanction of the War Department the order convening the Board will be issued from this office.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *February* 23, 1888.

The recommendation of the Chief of Engineers is approved.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT, *March* 26, 1888.

Respectfully referred to the Acting Judge-Advocate-General to prepare the formal approval in duplicate.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Fourth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., March 29, 1888.

Respectfully returned to the Secretary of War, with formal instrument prepared in duplicate, as directed in the preceding indorsement.

Attention is invited to the fact that the copy of the act of the general assembly of the Commonwealth of Kentucky, to amend the act to incorporate the Central Railway and Bridge Company, is not attested by the signature of the secretary of state of the State of Kentucky; the Commonwealth seal is, however, affixed to the copy of the act.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

PROTEST OF THE OHIO RIVER COMMISSION AGAINST THE CONSTRUCTION OF A NEW BRIDGE ACROSS THE OHIO RIVER AT CINCINNATI, OHIO.

At a meeting of the Ohio River Commission held at the Arlington House, in Washington, February 14, 1888, the following resolutions were adopted, to wit:

Whereas the Ohio River Commission recognizing the great benefits that railroads are to interstate commerce, and the necessity that at times arises to construct bridges across navigable rivers for the passage of through travel and freight, offer no protest against such bridges as may be absolutely necessary; and

Whereas they are unanimous in the opinion that unnecessary obstructions to the safe navigation of the Ohio is prejudicial to the navigation interests and commercial value of the Ohio, they protest against the multiplication of bridges whose chief object is personal profit, under disguise of public good; and

Whereas it is an ascertained fact that 35 per cent. of the loss in the transportation of coal by the Ohio River is in the navigation of 500 miles of the Ohio which is obstructed by bridges from accidents resulting therefrom; and

Whereas they are informed it is proposed to construct another bridge over the Ohio at Cincinnati, for the personal investment of capital as a source of individual profit, at a distance of but 1,200 feet from the railroad bridge; and

Whereas there are now three railroad bridges on that river at the port of Cincinnati, within a distance of two-thirds of a mile, and a suspension bridge for passengers and an effective ferry within the same space: Therefore,

Resolved, That in the judgment of the Commission of the Ohio River the proposed new bridge will greatly add to the dangers of navigating the Ohio, and is not a necessity for the accommodation of the individual wants of the citzens of Cincinnati, Newport, and Covington, and the Ohio River Commission earnestly protest against the construction of the said bridge.

Resolved, That the Ohio River Commission most respectfully but earnestly request the Secretary of War to scrutinize closely the purposes and the necessity for the construction of the proposed bridge, believing, as we do, that it is not a necessity, and will largely increase the difficulties and hazards of the navigation at that point, now already obstructed by the piers and dangers of four bridges within 1 mile distance.

Resolved, That the Ohio is almost the only transportation facility by which Cincinnati and other cities on the Lower Ohio and Mississippi rivers can be supplied with coal and salt at a cheap rate, it is the duty of the Government to remove instead of allowing the increase of obstacles to the safest, most commodious, and cheapest navigation of the Ohio.

Resolved, That these resolutions be presented by the president of this Commission to the Secretary of War.

JOHN A. SHANK,
President.

Countersigned:

A. S. BERRY,
Secretary.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., March 24, 1888.

SIR: I have the honor to submit herewith the report of the Board of Engineers convened, with the sanction of the War Department, by Special Orders, No. 11, paragraph 2, Headquarters Corps of Engineers, February 25, 1888, to examine and report upon plans and location of the proposed bridge of the Central Railway and Bridge Company of Newport, Ky., across the Ohio River, between Cincinnati, Ohio, and Newport, Ky., and to invite attention thereto.

It will be seen that the Board has given the subject the full consideration provided for by the acts of December 17, 1872, and February 14, 1883, and finds that "the requirements of the law as to length and location of channel-span are complied with, in that the clear space between the channel-piers is not less than 500 feet, measured on the low-water line, and these piers are so placed that the span crosses that part of the river usually run by descending coal fleets," but that the requirements of the act of February 14, 1883, "that 'the channel-span shall be at least 40 feet above local highest water measured to the lowest part of the span'" has not been literally complied with, inasmuch as "for a length of 208 feet in the middle of the channel-span the height is made 43.345 feet above the recognized highest water (64 feet on the water-works gauge), or 3.345 feet higher than required by law; but from the ends of this portion a descending grade extends towards each adjacent pier, and at the under side of each floor-beam nearest these adjacent piers the height is but 38.8 feet, or 1.2 feet less than required."

"All piers are parallel with the direction of the current at the stage most important for navigation."

While the Board attaches no importance to this departure from the strict requirements of the law because the minimum height is still practically greater than that at either the Newport and Cincinnati Railroad Bridge, 1,200 feet up-stream, or the suspension bridge below, it recommends the approval of the plans and location of the bridge under consideration subject to such modifications as to height of channel-span as the law requires.

Since the receipt of the report of the Board, however, a communication dated the 24th instant has been received from the consulting engineer of the bridge company, written with the sanction of the president of the company, requesting authority to amend the plans of the bridge so as to meet the objection of the Board and conform to the requirements of the law.

This privilege has been granted him, and he has made the required change in height of span accordingly.

No objection now is known to the approval of the plans by the Secretary of War, and it is recommended accordingly.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

REPORT OF BOARD OF ENGINEERS.

CINCINNATI, OHIO, *March* 17, 1888.

GENERAL: The Board of Engineer Officers constituted by paragraph 2, Special Orders, No. 11, Headquarters Corps of Engineers, dated February 25, 1888, "to examine and report upon plans and location of proposed bridge across the Ohio River between Cincinnati, Ohio, and Newport, Kentucky," have the honor to submit the following:

At the call of the senior member the Board met at the United States Engineer Office, custom-house, Cincinnati, Ohio, at 10 a. m., March 14, 1888, and continued in session during that and the three following days. Due public notice of the time and place of meeting was given by advertisement in the Cincinnati Enquirer, Pittsburgh Daily Dispatch, and the Charleston (W. Va.) Daily Star, and special notice by direct communication was given to those most prominently interested in the construction of the proposed bridge, as well as to those known to be opposed thereto, and particularly to such as are interested in coal transportation.

The first three days were devoted to public meetings, except the afternoon of the 14th, which was occupied in a personal examination of the proposed site of the bridge and its vicinity both from the shore and from the Newport and Cincinnati Railroad Bridge, and to a critical examination of the maps and plans transmitted for the consideration of the Board. The stage of water was about 21 feet and afforded reasonable opportunity for verifying the accuracy of the maps submitted to the Secretary of War by the bridge company.

During the public meetings of the Board the opposing parties interested were not only permitted but invited to present such facts as would be, in their estimation, of value in reaching a just conclusion. Each side called a number of experts in river navigation in the vicinity of the proposed site, who were questioned by the representative of each interest and, when necessary to a clear understanding by the Board, were further questioned by the latter. The persons having the greatest practical knowledge of the requirements for safe navigation of large coal fleets reported themselves unable to be present, and the Board was therefore deprived of the opportunity to examine them, but the statements of these experts as they were given in the case of the Cincinnati and Covington Bridge, now in course of construction, were available and were generally applicable to the case of the bridge in question.

The plans and evidence before the Board show that the requirements of the law as to length and location of channel-span are complied with, in that the clear space between the channel-piers is not less than 500 feet, measured on the low-water line, and these piers are so placed that the span crosses that part of the river usually run by descending coal fleets. The act approved February 14, 1883, requires than the "channel-span shall be at least 40 feet above local highest water, measured to the lowest part of the span." This requirement has not been literally complied with.

For a length of 208 feet in the middle of the channel-span the height is made 43.345 feet above the recognized highest water (64 feet on the water-works gauge), or 3.345 feet higher than required by law, but from the ends of this portion a descending grade extends towards each adjacent pier, and at the under side of each floor-beam nearest these adjacent piers the height is but 38.8 feet, or 1.2 feet less than required. Whilst this departure from the strict requirements of the law is a fact, the Board attaches no importance to it, because the minimum height named is still practically greater than that at either the Newport and Cincinnati Railroad Bridge, 1,200 feet up-stream, or the suspension bridge, a greater distance below.

All piers are parallel with the direction of the current at the stage most important for navigation.

Although the proposed bridge, except in the single particular referred to, complies with all the requirements of the acts of December 17, 1872, and February 14, 1883, yet its location, directly on a portion of the water-front, where business is active, seems to warrant the expression of the Board's opinion that in such busy harbors as that of Cincinnati all piers in the navigable portion of the river are very objectionable, and that the interests of navigation can only be properly subserved by bridges with considerably longer spans than are now required by law. However, in view of the privileges granted by existing laws, the Board would not be justified in reporting that the site of the proposed bridge is unfavorable, or in recommending other changes in the bridge or its piers than those required by the law.

The Board therefore recommend the approval of the plans and location of the proposed bridge, subject to such modifications as to height of channel-span above highest water as the laws require. At the same time they beg leave to remark that, if any discretion in the matter were left to them, they would recommend that, for reasons already given, this requirement should not be insisted upon.

All of which is respectfully submitted.

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Genl., U. S. A.
AMOS STICKNEY,
Major of Engineers.
A. MACKENZIE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF CONSULTING ENGINEER OF CENTRAL BRIDGE COMPANY.

WASHINGTON, D. C., *March* 24, 1888.

GENERAL: Having been informed that an objection has been raised with regard to the approval of the plans submitted by the Central Bridge Company, for its proposed bridge across the Ohio River, between Cincinnati and Newport, arising from the fact that the two floor-beams next to the piers of the channel-span are slightly lower than required by law, I desire to ask your permission to amend the plans submitted by raising the floor-beams in question to 40 feet above high-water in order that there shall be as little delay as possible in the approval of the plans.

This modification will place every foot of the superstructure of the channel-span 40 feet or more above high water, as required by law.

I would state that I am authorized by the president of the bridge company, through verbal instructions, to make this modification.

Very respectfully,

G. BOUSCAREN,
Consulting Engineer, Central Bridge Company.

Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., April 28, 1888.

SIR: The Secretary of War has, under date of the 18th of April, 1888, approved plan and map of location submitted by the Central Railway and Bridge Company for proposed bridge between the cities of Newport, Ky., and Cincinnati, Ohio, with the understanding and agreement "that this approval is given upon the express condition that the Engineer Officer of the United States Army in charge of the district within which the bridge is to be built may supervise its construction, so far as may be necessary, in order that the plans herein approved shall be complied with and the bridge built accordingly."

Copies of tracings showing plan and location of the bridge, with copy of the approval of the Secretary attached, are sent herewith for your information and guidance.

By command of Brigadier-General Duane.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Lieut. Col. WILLIAM E. MERRILL,
Corps of Engineers.

W W 17.

BRIDGES OF THE GEORGIA PACIFIC RAILROAD COMPANY ACROSS THE SUNFLOWER AND YAZOO RIVERS, AUTHORIZED BY ACT OF CONGRESS APPROVED MARCH 3, 1887.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., August 30, 1887.

SIR: I have sent three tracings, marked A, B, and C, in another package, and I transmit herewith a letter marked D, from E. C. Carroll and others, all referring to a railroad bridge proposed to be built across Yazoo River, in the State of Mississippi.

Tracing A was made from a map submitted by S. H. Purcell, of Greenville, Miss., division superintendent Georgia Pacific Railroad Company. I have been over the stretch of river represented, and I have shown the map to pilots and others who are acquainted with the upper river, and we agree that the map is correct. I have no surveys with which I can compare this one, and there are no well-determined bench-marks for elevation nearer than Greenville or Yazoo City, but the high-water mark is evident to the eye, and the elevation of low water may be accepted as near enough for practical purposes.

I believe that this bridge is the one authorized by the act approved March 3, 1887, Public 172, and that the place of crossing is as prescribed at Glen Mary, above the upper mouth of Roebuck Lake.

Tracing A shows a straight piece of river for 1 mile above and below the proposed crossing, which is about 10 miles below Greenwood and about 260 miles above Vicksburg. The low-water channel is about 300 feet wide, of uniform section, and of sufficient depth for the largest boats in the trade, and with the channel-line in mid-stream. The banks are generally higher than ordinary high water and are permanent to a certain degree. That is to say, overflow from Mississippi River being now cut off by the completion of the levees on Yazoo Front, it is not probable that this reach will change materially from its present condition.

The place of crossing seems to be well chosen with reference to landings above and below, and the axis is normal to the channel line; but the arrangement of piers and the width of draw passage are not good. As it would be unreasonable to require a high bridge with single span, or a swing-bridge so large as to need steam-power, it only remains to suggest dimensions for a swing-bridge of the largest size that can be maneuvered conveniently by hand to give reasonably safe passage at any stage of the river.

Referring to section on tracing A, it will be seen that only one opening can be used at low water, and that a considerable rise would have to occur before the east passage could be used. Besides, from the unequal contraction caused by Pier C, it is almost certain that there would be a strong cross-current from the east bank above the bridge that would make the passage on that side dangerous to up-stream as well as down-stream boats.

Moving Pier C eastward would improve the east passage, but at best the openings are not wide enough.

Tracing B gives openings of 115 feet, but with Pier C at its first position the east opening is still useless.

The dimensions in this case were taken from a bridge crossing Yazoo River near its mouth, it being assumed that steam-boat men thought them sufficient, because they had not entered complaints. The county bridge near Yazoo City has openings less than 90 feet in the clear, so that at first blush it would seem unreasonable to require greater openings in a bridge 150 miles further up the river. But if unauthorized or dangerous bridges may be taken as models, the extreme can be found in the railroad bridge of the Valley Line across Black River, in this State. The company, under State charter, had authority to build a draw-bridge across that stream near its mouth, but it put up a low fixed bridge, and contracted the water-way by piling, so that only flat-boats can pass. The railroad bridges at Shreveport and Garland City, across Red River, were built without reference to the War Department. The former is now impassable at any stage under 5 feet, and the latter, giving only one opening, and that one badly placed, fell into the river early this month and completely bars the river between the piers of the fixed spans. The United States are spending large sums on the streams in this district, but it will have been thrown away if the privilege of crossing them is not to be subject to a proper control. It is time to make a beginning.

Mr. Purcell, finding that there would be strong opposition to any bridge, and certainly to the bridge proposed as on tracing B, suggested that if I recommended clear openings of 125 feet, Pier C might be moved further west. This is a move in the right direction, for with Pier C in the first position there could be but one safe passage, no matter how large a draw were built. A great deal of annoyance and delay might have been avoided if these dimensions had been assumed in the first instance, for I suggested them myself to Mr. Purcell in July.

After a careful study of the section, and trial of a number of sections, I submit tracing C. The intersection of the axis of the bridge with the transit-line on the west bank marked 20 is assumed as correctly located and recoverable, and the centers of Piers A, B, C, D, and E are supposed to be on the axis normal to the channel line at or near the place indicated by their number, which means so many feet from a certain point.

I recommend that permission be given to construct the bridge on the line indicated, the pivot-pier C to be at 23 and to be not over 30 feet in diameter, the draw-span to be of such length as to give openings on each side of Pier C not less than 125 feet in the clear and preferably not less than 130 feet. Piers B and D to be placed so that their centers shall not be nearer to Pier C than at 21.55 for B and at 24.45 for D, if the clear openings be made 125 feet, and proportionally removed if larger openings be required. Pier A to have its center no further east than 20.50, and Pier E its center no further west than 25.

Piers A and E may be built with wing-walls and filled behind with earth or piling, or trestle may be allowed.

The bottom chords of the supertructure between A and E should be placed at least 3 feet above highest floods to prevent accumulation of drift, and no projection trestle or piling should be allowed to form any part of the permanent work in the spaces between piers from A to E.

All the requirements of the act should be guarantied, and in addition an agreement should be obtained for obedience to rules for prompt opening on reasonable signal, maintaining proper lights, etc., as provided, for example, in section 2, No. 168, and sections 3, Nos. 171 and 181. It seems to be particularly necessary to allude to these points because, as a matter of fact, bridge tenders are notoriously careless and negligent. I have formed this opinion from hearing the experiences of others and from my personal observation on Hudson River, Mississippi, Yazoo, and Red rivers.

In submitting tracing C, I am not to be understood as offering a design for a bridge, but only a sketch to show what seemed to me to be the best arrangement for piers and spans. The dimension and arrangement of panels of the draw-span, however, were taken from a bridge built by the late Shaler Smith. The length of draw truss is 294 feet 8 inches center to center of pins and the dimensions of piers about the same throughout.

This bridge is a fine structure, was not very expensive, is used for general traffic as well as railway, and the draw is worked by hand easily and quickly.

Very respectfully, your obedient servant,

J. H. WILLARD,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE GENERAL MANAGER OF THE GEORGIA PACIFIC RAILWAY COMPANY.

THE GEORGIA PACIFIC RAILWAY COMPANY,
Birmingham, Ala., September 30, 1887.

DEAR SIR: I send you by express to-day maps, profiles, plans, etc., covering our proposed crossing at Sunflower and Yazoo rivers, which, together with papers now in the hands of Major Post, complete, I believe, all the information required, which we desire to submit for your consideration and approval, and would request that you give the matter your earliest consideration, as we desire to commence operations, especially at Sunflower, before the high-water season sets in.

Yours, very truly,

I. Y. SAGE,
General Manager.

CHIEF OF ENGINEERS, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 14, 1887.

Respectfully submitted to the Secretary of War through the Acting Judge Advocate-General, U. S. Army.

The within plans for the bridges across the Sunflower and Yazoo rivers, provided for by "An act to authorize the Georgia Pacific Railroad Company to construct bridges across the Sunflower, Yazoo, and Tombigbee rivers in Mississippi," approved March 3, 1887, are submitted by the Georgia Pacific Railroad Company.

The plans for the bridge across the Sunflower River are in accordance with the provisions of the act of March 3, 1887, and are recommended for approval, subject to the condition that such services be maintained by the railroad company as may be necessary to insure prompt opening of the draw on reasonable signal, and that such signals be displayed as are customary, or as are now and may hereafter be prescribed by the Light-House Department.

In regard to the plans for the bridge across the Yazoo River, which provide for a swing-bridge with openings of 115 feet in the clear, it is believed that the draw-openings are not sufficient to meet the requirements of navigation, and that they should be increased to 125 feet, as recommended by Capt. J. H. Willard, Corps of Engineers, in his report dated August 30, 1887, herewith, to which attention is respectfully invited. It will be seen that Captain Willard recommends that the bridge be constructed on the line indicated on tracing C accompanying his report, the piers to be located so that there will be a draw-opening of a clear width of 125 feet upon both sides of the pivot-pier, the latter to be so placed as to include the best water in the draw-openings, the bottom chords of the superstructure to be placed at least 3 feet above highest floods to prevent accumulation of drift, and no projecting trestle or piling to be allowed to form any part of the permanent work in the spaces between piers. The views of Captain Willard are concurred in, and it is suggested that the railway company be furnished with a copy of Captain Willard's report on the Yazoo Bridge, with request that they present plans in conformity therewith.

CHAS. W. RAYMOND,
Acting Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., October 20, 1887.

Respectfully forwarded to the Secretary of War, with formal instrument for his approval (prepared in duplicate) of the design and drawings and map of the location of the bridge proposed to be built by the Georgia Pacific Railroad Company across the Sunflower River, in the State of Mississippi.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, October 22, 1887.

SIR: In reply to your letter of the 30th ultimo, transmitting, for approval by the Department, plans of a bridge proposed to be constructed across the Yazoo River by the Georgia Pacific Railway Company, I have the honor to inclose, for the information of the company, a copy of a report upon the proposed bridge by Capt. J. H. Willard, Corps of Engineers, with accompanying tracing, as suggested by the Acting Chief of Engineers, a copy of whose report of the 14th instant is also herewith.

Very respectfully, your obedient servant,

WILLIAM C. ENDICOTT,
Secretary of War.

I. Y. SAGE, Esq.,
General Manager Georgia Pacific Railway Company,
Birmingham, Ala.

LETTER OF THE GENERAL MANAGER OF THE GEORGIA PACIFIC RAILWAY COMPANY.

THE GEORGIA PACIFIC RAILWAY COMPANY,
Birmingham, Ala., January 23, 1888.

DEAR SIR: The Georgia Pacific Railway Company desire to submit for the approval of the War Department the inclosed plans for constructing the draw-bridge across the Yazoo River. These plans have been prepared in accordance with the suggestion of William C. Endicott, Secretary of War, October 22, 1887, based upon the recommendations of Charles W. Raymond, Acting Chief of Engineers, October 14, 1887, transmitting the report of J. H. Willard, Captain of Engineers, August 30, 1887.

Yours, very truly,

I. Y. SAGE,
General Manager.

CHIEF OF ENGINEERS, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 7, 1888.

Respectfully submitted to the Secretary of War. The within plans for the proposed bridge of the Georgia Pacific Railway Company across the Yazoo River, prepared under authority granted by an act approved March 3, 1887, are in accordance with the requirements of the War Department, and are recommended for approval, subject to the condition that such services be maintained by the railroad company as may be necessary to insure prompt opening of the draw on reasonable signal, and that such signals be displayed as are customary, or as are now and may hereafter be prescribed by the Light-House Department.

The previous papers in the case were submitted to the War Department with indorsement of this office, dated October 14, 1887.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
February 9, 1888.

Respectfully referred to the Acting Judge-Advocate-General to prepare the formal approval, in duplicate, with conditions as proposed by the Chief of Engineers.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., February 15, 1888.

Respectfully returned to the Secretary of War, with formal instrument (prepared in duplicate), for his approval of the plans and location of the bridge proposed to be built by the Georgia Pacific Railroad Company across the Yazoo River, in the State of Mississippi.

Attention is invited to the fact that the extracts from the company's minutes, purporting to show the names of the officers of the company, are extracts from the minutes of meetings held respectively November 29 and December 18, 1886, at which meetings officers and directors were elected for the then ensuing year. There is nothing to show that the officers then elected are the present officers of the company.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER TO THE PRESIDENT OF THE GEORGIA PACIFIC RAILWAY COMPANY.

THE GEORGIA PACIFIC RAILWAY COMPANY,
Birmigham, Ala., March 24, 1888.

SIR: Referring to your favors, October 21, 1887, and February 4, 1888, to I. Y. Sage, general manager, relative to the Sunflower River Bridge of this company, and to other letters relative to the Yazoo River Bridge of this company, I beg to explain that the delay in signing and returning the papers has been due to the fact that an error appears in the act of Congress approved March 3, 1887, in that the corporate name of this company is given as the "Georgia Pacific Railroad Company." Under the circumstances it was thought best to withhold the papers until another act of Congress could be gotten correcting this mistake and giving longer time within which to build the bridges. I have now advices from Senator George that the necessary bill has been passed in the Senate, and Representative Allen writes me that he hopes to pass this bill through the House next week.

We have recently sent to the office of the Chief of Engineers plans for our proposed bridge over the Tombigbee River, which bridge is covered by the same acts of Congress, and I hope that the papers for this bridge also can soon be gotten in shape for proper execution. So soon as the pending act of Congress becomes a law I will be prepared to execute the papers as to the Sunflower and Yazoo River bridges, and will do so and promptly return them to you.

Very respectfully, your obedient servant,

JNO. W. JOHNSTON,
President Georgia Pacific Railway Company.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, April 28, 1888.

SIR: Referring to Department letter to you of the 25th instant, relative to the bridges authorized to be erected by the Georgia Pacific Railway Company across the Yazoo and Tombigbee rivers, I have the honor to state that by inadvertence two copies of the instrument indicating approval of the plans of the bridge across the Yazoo River were transmitted to you, and to request that you return one of the copies in question to the Department.

I inclose for retention by your company a duly-executed copy of an instrument indicating approval by the Secretary of War, under certain specified conditions, of the location and plans of the bridge authorized to be constructed by the company over the Sunflower River, under the provisions of the act of Congress approved March 3, 1887, and the amendatory act approved April 2, 1888.

Very respectfully,

WILLIAM C. ENDICOTT,
Secretary of War.

Mr. J. W. JOHNSTON,
President Georgia Pacific Railway Company,
Birmingham, Ala.

LETTER OF THE PRESIDENT OF THE GEORGIA PACIFIC RAILWAY COMPANY.

THE GEORGIA PACIFIC RAILWAY COMPANY,
Birmingham, Ala., May 5, 1888.

SIR: I have the honor to acknowledge receipt of your favor, 28th ultimo, inclosing for retention by this company an executed copy of the

Major Mackenzie's views are concurred in and no objection exists to the approval of the plans of the bridge within submitted by the Secretary of War.

JAS. C. POST,
Acting Chief of Engineers.

[Fourth indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., March 17, 1888.

Respectfully forwarded to the Secretary of War.

The accompanying papers are complete, with the exception of the extracts of the company's minutes showing the names of the present officers of the company, and the acceptance by the company of the provisions of the act of Congress granting the privilege in question, which do not accompany these papers. The evidence of the acceptance by the company of the provisions of the act of Congress is essential under the rule of the War Department of July 31, 1886.

G. NORMAN LIEBER,
Acting-Judge-Advocate-General.

[Fifth indorsement.]

WAR DEPARTMENT,
March 19, 1888.

Respectfully returned to the Chief of Engineers, inviting attention to the fourth indorsement.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Sixth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
April 24, 1888.

Respectfully returned to the Secretary of War, through the Acting Judge-Advocate-General, U. S. Army, with the papers referred to in the fourth indorsement.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Seventh indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., April 30, 1888.

Respectfully forwarded to the Secretary of War, with instrument (prepared in duplicate) for his approval of plan and location of the bridge constructed by the Dubuque Ponton Bridge Company over the Mississippi River between the city of East Dubuque, Ill., and the city of Dubuque, Iowa.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

[Eighth indorsement.]

WAR DEPARTMENT,
April 30, 1888.

Respectfully returned to the Chief of Engineers to have the acceptance executed by the proper officer of the Dubuque Ponton Bridge Company.

By order of the Acting Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Ninth indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 19, 1888.

Respectfully returned to the Secretary of War with the acceptance duly executed in accordance with the requirements of the foregoing indorsement.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

REPORT OF MAJOR A. MACKENZIE, CORPS OF ENGINEERS, ACCOMPANYING SECOND INDORSEMENT ON THE FOREGOING COMMUNICATION.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., February 2, 1888.

GENERAL: By an indorsement dated Office Chief of Engineers, September 26, 1887, I was requested to ascertain whether the high bridge across the Mississippi River at Dubuque, Iowa, was the one referred to in the act of Congress approved February 21, 1887, and whether the bridge is constructed upon the location and according to the plans presented by the "Dubuque Ponton Bridge Company" and forwarded to the Chief of Engineers with my letter of January 13, 1887; also whether in my opinion this high wagon bridge is a "substantial obstruction to the navigation of said river."

Immediately upon receipt of the papers I addressed letters to the managers of the packet companies on the Upper Mississippi, requesting dimensions of their packets and their opinion as to possible dimensions of the boats of the future which might be considered most suitable to the upper river trade. The last reply to my inquiries has just been received.

The high wagon bridge at Dubuque, Iowa, opened for travel November 29, 1887, was built by the Dubuque Ponton Bridge Company. Construction was commenced under authority supposed by the company to be granted by an act of Congress approved March 3, 1875, and amended by act approved May 29, 1884. These acts authorized the construction of a ponton bridge, and permission was granted to the "East Dubuque Bridge Company" to construct a ponton bridge. This company transferred all their rights and franchises to the "Dubuque Ponton Bridge Company," which changed the plans and built the existing high bridge.

Attention being called to the fact that the act of Congress did not authorize such a structure as was being built, the matter was presented to Congress by the bridge company, and an act of Congress, approved February 21, 1887, authorized the "Dubuque Ponton Bridge Company," the company holding the franchise of the "East Dubuque Bridge Company," to construct in lieu of the pontoon bridge a high wagon bridge, and it is under this act that the existing high bridge at Dubuque was completed. By the act of February 21, 1887, the acts referring to a pontoon bridge were virtually repealed, and there now exists no authority for the further construction of bridges under the acts of Congress herein referred to.

I would therefore reply that the high bridge across the Mississippi River at Dubuque, Iowa, is the one referred to in the act of Congress approved February 21, 1887, and the bridge is built on the location and according to the plans originally forwarded with my letter of January 13, 1887.

This high bridge is located immediately below the existing railroad bridge, with piers in same line. So far as widths of spans are concerned, the bridge satisfies all demands of navigation. From measurements taken since the bridge was completed, it appears that the clear heights given are very slightly in excess of those indicated on the plans submitted. The clear headway above high water of 1880 given by the bridge are as follows:

	Feet.
At a point 20 feet east of west channel pier	51.0
At a point 50 feet west of draw protection of railroad bridge	54.8
At a point 30 feet west of draw protection of railroad bridge	55.56

The available height may therefore be considered at 54.8 feet above the high water of 1880, the highest of which we have authentic record.

The largest boats now navigating the Upper Mississippi River are the *Saint Paul* and *War Eagle*, of the Saint Louis and Saint Paul Packet Company, and the managers of the line report that they consider the *Saint Paul* a model boat for the upper-river trade, and would follow her dimensions in the construction of new boats. The chimneys and pilot-houses of these boats are higher than those of any of the Diamond Jo Line steamers.

The heights for the *Saint Paul* above water-line are: Top of chimneys, 61.6 feet; top of pilot-house, 48 feet; and these are the heights to be taken in connection with a consideration of the Dubuque High Bridge as a substantial obstruction to navigation. On the Ohio River, where high bridges are common, it is customary to consider the height of the pilot-house only, it being practicable to lower chimneys, and an excess of 3 feet above pilot-house is usually given.

Considering the heights, it appears that all boats now used on the Upper Mississippi, even when light, would, so far as tops of pilot-houses are concerned, pass under the Dubuque High Bridge at extreme high water, and their chimneys would also pass under without lowering whenever stage was less than 7 feet below extreme high water. A higher stage than 7 feet below extreme high water is not common, and is of comparatively short duration.

During high water it has happened that the larger class of steamers from the Ohio or the Lower Mississippi have been sent for an occasional trip through to Saint Paul. Such a class of boats could not in all cases pass under the Dubuque High Bridge; but as such class is not adapted to the Upper Mississippi River, and do not properly belong there, they they have not been considered.

Some navigators think a height of 60 feet above high water should be given, and of course such height would be better than 55; but to call for a greater height than is absolutely necessary is somewhat unreasonable.

Certain booms, connecting the piers of the high bridge with the corresponding piers of the railroad bridge, are required, and the owners of the high bridge express a willingness to put them in as soon as practicable. If this is not done, as promised, the booms can be called for under section 8 of the river and harbor act of July 5, 1884.

As it appears that the height given the Dubuque High Bridge furnishes reasonable accommodation to the steam-boats now navigating the Upper Mississippi River, I am of the opinion that the bridge is "no substantial obstruction to navigation of said river." The height given is greater than is required by the rules laid down by General Warren in his report on "Bridging the Upper Mississippi River from Saint Paul to Saint Louis."

One copy of plans of bridge as proposed accompanied the original papers. These plans show the bridge as built, and duplicate copies have been procured as requested.

The construction of the Dubuque High Bridge will make necessary arrangements for lowering the chimneys of some of the steam-boats now navigating the Upper Mississippi River. It has been claimed that the expense of such work is a fair charge against the bridge company; but on this point I do not feel it my province to express any opinion.

Very respectfully, your obedient servant,

A. MACKENZIE,
Major of Engineers.

The Chief of ENGINEERS, U. S. A.

W W 19.

BRIDGE OF THE OHIO CONNECTING RAILWAY COMPANY ACROSS THE OHIO RIVER NEAR THE MOUTH OF CORK'S RUN, IN ALLEGHENY COUNTY, PENNSYLVANIA, AUTHORIZED BY ACT OF CONGRESS APPROVED MAY 14, 1888.

PITTSBURGH, CINCINNATI AND ST. LOUIS RAILWAY CO.,
CHIEF ENGINEER'S OFFICE,
Columbus, Ohio, May 24, 1887.

DEAR SIR: I am directed by the Ohio Connecting Railway Company, a corporation chartered by the State of Pennsylvania, to present to you, in accordance with the law governing the construction of bridges over the Ohio River, plans for the erection of a bridge across the Ohio River about 1 mile below the junction of the Allegheny and Monongahela rivers at Pittsburgh, Pa. The plans herewith submitted consist of—

(1) A map of the Ohio River on a scale of 200 feet per inch, showing high and low water marks and the shore topography and the river bottom contour lines.

(2) A map of the Ohio River showing the current lines and velocities of the river above and below the proposed bridge site on a scale of 200 feet per inch.

(3) A plan of the masonry piers Nos. 4 and 6, being the two shore piers, on a scale of one-eighth of an inch per foot,

(4) Plan of Pier No. 5, being the middle pier, on a scale of one-eighth of an inch per foot.

(5) The profile and plan of bridge across the Ohio River on a scale of 40 feet per inch.

Very respectfully, yours,

M. J. BECKER,
Chief Engineer Ohio Connecting Railway Company.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 26, 1887.

Respectfully returned to the Secretary of War.

The maps required by section 4 of "An act supplementary to an act approved December 17, 1872, entitled, 'An act to authorize the construction of the bridges across the Ohio River, and to prescribe the dimensions of the same,'" approved February 14, 1883 (copy herewith), submitted by the Ohio Connecting Railway Company, under the provisions of that section "shall be referred to a Board of Engineers for examination and report, which Board shall personally examine the site of the proposed bridge, and shall hold a public session at some convenient point to hear all objections thereto, of which public session due notice and invitation to be present shall be given to all interested parties," etc.

It is accordingly recommended that a Board of Officers of the Corps of Engineers be constituted, to meet at Pittsburgh, Pa., upon the call of the senior member, and at such time as the other duties of the members will permit, to consider and report upon the plans in question. The Board to consist of Lieutenant-Colonels W. E. Merrill and J. W. Barlow, and Maj. Amos Stickney, with Lieut. E. J. Spencer as recorder. If approved by the Secretary of War, the Board will be convened by orders from this office.

It is suggested that the attention of the railroad authorities be called to the requirements of the "rule to be observed when application is made, pursuant to an act of Congress, for the approval by the Secretary of War of plans for a bridge," etc., dated July 31, 1886, and also to the fact that there is no evidence contained in the paper submitted by them that the first part of section 4, before referred to, in regard to publication, has been complied with.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *May* 26, 1887.

The recommendation of the Chief of Engineers in regard to the Board of Engineers is approved.

Mr. Becker's attention was called to the rule of the Department dated July 31, 1886, and to the requirements of section 4 of the act approved December 17, 1872, on the 25th instant.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

[Third indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 28, 1887.

Respectfully returned to the Secretary of War, inviting attention to the accompanying report of the Board of Engineers, appointed with his sanction by Special Orders No. 60, current series, from this office, to consider and report upon the plans submitted by the Ohio Connecting Railroad Company for their proposed bridge across the Ohio River at about 1 mile below the junction of the Allegheny and Monongahela rivers at Pittsburgh, Pa. The report of the Board is concise in terms, and shows that the subject has received the careful consideration which the importance of the interests involved demands. The Board states "that, after careful study of the drawings and of the ground, the Board have concluded that the site selected by the bridge company is unusually unfavorable to the river interests." They "also find that the line of the proposed bridge is not normal to the current at all stages, as required by law, but departs from such a line by an angle of 13°. * * *

"After mature deliberation the Board feel constrained to state that, in their best judgment, any bridge at the locality selected by the Ohio Connecting Railway Company, except one spanning the whole width of the river, would be objectionable, but they believe that with a change in axis, as recommended, and a clear opening of 800 feet, measured on the low-water line, a bridge at the site selected would be admissible. The increase in channel space should be given by moving the south channel pier nearer to the south shore."

In conclusion, the Board recommends "that the site selected by the bridge company be accepted on the condition that the axis of the bridge be changed as recommended, and that the channel space be increased to 800 feet, but that otherwise the site be rejected. They also recommend that the company be notified that the location which crosses Brunot's Island, as indicated above, will be acceptable to the United States, and that they are at liberty to bring up other sites for examination in case neither of the two named is accepted under the conditions herein imposed."

The views of the Board are concurred in by this office, and it is recommended that a copy of their report be furnished the Ohio Connecting Railway Company for their information.

It may be proper to invite attention to the letter of Lieut. Col. William E. Merrill, in which it is stated that the duplicates of maps and papers required by the rule of the War Department will be sent by the company direct to this office.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

FIRST REPORT OF BOARD OF ENGINEERS.

JUNE 25, 1887.

The Board of officers of the Corps of Engineers appointed by Special Orders, No. 60, dated Headquarters Corps of Engineers, Washington, D. C., May 27, 1887, to "consider and report upon the plans of the proposed bridge across the Ohio River about 1 mile below the junction of the Allegheny and Monongahela rivers, submitted by the Ohio Connecting Railway Company," would respectfully submit the following report:

The Board met at Pittsburgh on the 14th of June, in accordance with the call of the senior member, and held a public session in the Monongahela House, of which public session due notice and invitation to be present was given to all interested persons by advertisement in two newspapers in the city of Pittsburgh and in two newspapers in the city of Cincinnati.

At this session the Ohio Connecting Railway Company was represented by the chief engineer and by the general manager of the lines of the Pennsylvania Company west of Pittsburgh, and the river interests were represented by a number of leading coal operators.

The orders convening the Board were duly read, and the maps were examined and informally discussed by those present. Meanwhile the coal operators had arranged to take a tow of empty barges down to the site of the proposed bridge in order to illustrate, as far as practicable, the method of navigating that part of the river by coal tows, and the bridge engineers had marked by buoys the location of the proposed channel-piers.

In the afternoon the members of the Board and the representatives of river and rail transportation met, by invitation, on a tow-boat belonging to Mr. Simpson Horner, to which a tow of nine empty barges had been attached, and proceeded down the river to the head of Brunot's Island. As the river was about 3 feet below a barge stage, causing a slack current in the natural pool above Brunot's Island, and as an upstream wind was blowing, it was not practicable to handle a tow of empty barges as would have been done with a loaded tow; but the method of navigating this piece of river was very clearly pointed out.

Owing to the swiftness of the current through the Glasshouse Channel it was considered unadvisable to take the fleet below the head of Brunot's Island, and accordingly it was dropped at Brown's Landing, and the tow-boat, with its passengers, proceeded to a point near the foot of the island, where an examination was made of a bridge site which was considered by river men as the least objectionable of any in this section of the river; from this point the party returned to Pittsburgh.

After careful study of the drawings and of the ground the Board have concluded that the site selected by the bridge company is unusually unfavorable to the river interests. From the Smithfield Street Bridge to Brunot's Island is the natural pool in which coal boats and barges are held until a rise in the river permits their passage to southern markets. The whole length of the southwest banks of the Monongahela and Ohio rivers, within the length named, is usually lined with loaded coal boats and barges, and a few are held against the right bank. When a rise comes these barges and boats are rapidly tied up into fleets and pushed down the river. The channels on either side of Brunot's Island are difficult and dangerous to run. The regular or right-hand channel has a very abrupt turn at its head, into what is known as the Glasshouse Channel; but after making this turn there is no further trouble, as the channel is nearly straight for many miles. The left-hand or back channel is easy and straight at the head, but it is very crooked at the foot, especially at McKee's Rocks, where it is necessary to make an abrupt turn through more than a right angle. Moreover, this channel is impassable in low water on account of a low riprap dam just below the mouth of Chartier's Creek, and as a rule it is never used except in cases of necessity. As matters now stand the right-hand or Glasshouse Channel is the channel that is actually used by coal fleets and barges, and it must therefore be considered as the present channel of the Ohio River at this locality.

The Board find as statements of fact that Ohio River coal fleets are always made up of boats and barges tied and chained together so as to make a solid mass, with the tow-boat at the stern, firmly fastened to the fleet, with about two-thirds of its length projecting to the rear as a huge rudder; that the tow-boat is always a stern-wheeler, handling her tow mainly by use of the currents; that fleets are made up in the harbor of Pittsburgh with their heads up stream; that as they float down they throw their sterns into still water and their heads into swift water, in order to turn the tow and head it down-stream; that the operation is usually carried on by throwing the stern over to the right bank; that, owing to the limited length of the pool, boats frequently drift down to the head of the Glasshouse Channel, with their tows crosswise of the river, almost touching either bank; that when just above the head of Glasshouse the stern is backed up against the right or Allegheny shore, and the fleet, swinging on the stern as a center, describes the arc of a circle until the current draws the head into the Glasshouse Channel; and the rest of the tow is then allowed to follow. The Board also find that fleets sometimes miss the turn into Glasshouse and are compelled to make their way down by the back channel, and that sometimes when swinging into Glasshouse they can not hold up strong enough against the right bank, and are drawn onto the bar at the head of Brunot's Island.

From these facts it is evident to the Board that at every coal run the great majority of the fleets actually and necessarily pass *over* the spot selected for the left-hand channel-pier, and the creation of such an obstacle at such a place would not only cause great loss of property, but would ultimately force the abandonment of the present method of making up coal fleets, and compel the passage of this place by a few barges at a time, transferring to some point below the assembling into fleets for passage down the river. As the natural pools in the upper end of the Ohio River are very short, this necessity would create great embarrassment, would add considerably to the cost of transportation, and would reduce the amount of coal that could be shipped during short summer rises, on account of the impossibility of getting it ready during the limit of time available.

The Board also find that the line of the proposed bridge is not normal to the current at all stages, as is required by law, but departs from such a line by an angle of 13°. Assuming the south end of the proposed bridge to be fixed, the axis should be swung to the east through an arc of 13° in order to be at right angles to the current.

It has been suggested that if there were several movable dams on the Ohio fleets would no longer be made up in Pittsburgh, but at points below, and that there would then be no valid objection to the proposed bridge. The Board agree with the suggestion, provided the axis of the bridge were changed as indicated, but do not feel at liberty to anticipate the future; and therefore consider themselves to be under the necessity of basing their report and recommendations on what now exists at the location in question.

After mature deliberation the Board feel constrained to state that in their best judgment any bridge at the locality selected by the Ohio Railway Connecting Railway Company, except one spanning the whole width of the river, would be objectionable; but they believe that with a change in axis, as recommended and a clear opening of 800 feet, measured on the low-water line, a bridge at the site selected would be admissible. The increase in channel space should be given by moving the south channel-pier nearer to the south shore.

It was suggested that a site at Saw-mill Run, with a central span somewhat greater than that called for by law, would not be seriously objected to by the river interests. The Board have not investigated this site in detail, as the railroad authorities protested against it, and stated that the objections to it from their point of view were insuperable.

A third line was suggested, which crossed the back channel 3,100 feet below Cork's Run, and runs in a straight line across both channels at Brunot's Island to a point about 50 feet north of the center of the stock-yards. It was stated by the representatives of the river interest that such a line, if provided with a 400-foot opening over the back channel and a 500-foot opening over the main channel, would be acceptable to them. In that case the southern pier of the 400-foot span in the back channel should be located about 60 feet north of the intersection of the axis of the bridge with the pool-line of the Davis Island Dam at that locality, and the northern pier of the main-channel span should be placed about 100 feet south of the corresponding intersection on the right bank of the main channel.

In conclusion, the Board would recommend that the site selected by the bridge company be accepted, on the condition that the axis of the bridge be changed as recommended, and that the channel-space be increased to 800 feet; but that otherwise the site be rejected. They also recommend that the company be notified that the location which crosses Brunot's Island, as indicated above, will be acceptable to the United States; and that they are at liberty to bring up other sites for examination in case neither of the two named is accepted under the conditions herein imposed.

Respectfully submitted.

WM. E. MERRILL,
Lieut. Col. of Engineers.
J. W. BARLOW,
Lieut. Col. of Engineers.
AMOS STICKNEY,
Maj. of Engineers.
E. J. SPENCER,
First Lieut. of Engineers,
Recorder.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE CHIEF ENGINEER OF THE OHIO CONNECTING RAILWAY COMPANY.

OHIO CONNECTING RAILWAY COMPANY,
Columbus, Ohio, September 7, 1887.

DEAR SIR: In accordance with the report of the Board of United States Engineers of June 25, 1887, which accompanied your letter of June 30, 1887, to myself, I submit herewith plans of the revised location of a bridge for the Ohio Connecting Railway, over the Ohio River at Brunot's Island, near Pittsburgh, Pa., as recommended by the Board.

These plans consist of—

(1) A map of the Ohio River on a scale of 200 feet per inch, showing high and low-water mark and shore topography and contour lines of the river bottom.

(2) A map of the Ohio River, showing the current lines and velocities above and below the proposed bridge site on a scale of 200 feet per inch.

(3) A plan and profile of the proposed bridge on a scale of 40 feet per inch.

(4) A plan and profile of the proposed bridge on a scale of 40 feet per inch, indorsed by a committee of the Coal Exchange of Pittsburgh.

In compliance with the law, duplicates of each of the foregoing are also inclosed herewith for file in the office of the Chief of Engineers.

Yours truly,

M. J. BAKER,
Chief Engineer.

HON. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
September 15, 1887.

Respectfully returned to the Secretary of War.

It is recommended that the Board of officers of the Corps of Engineers which considered the original maps and plans submitted by the Ohio Connecting Railway Company for a bridge across the Ohio River near Pittsburgh, Pa., be reconvened, with the exception of Lieut. E. J. Spencer, recorder, at Pittsburgh, Pa., upon the call of the senior member, at such time as the other duties of the members will permit, to consider and report upon the plans now submitted by that company.

If approved by the Secretary of War, the Board will be reconvened by orders from this office.

Previous papers herewith.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *September* 15, 1887.

The recommendation of the Chief of Engineers in the first indorsement is approved.

By order of the Acting Secretary of War.

L. W. TOLMAN,
Acting Chief Clerk.

LETTER OF LIEUTENANT-COLONEL WILLIAM E. MERRILL, CORPS OF ENGINEERS, TRANSMITTING SECOND REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, October 14, 1887.

SIR: I have the honor to transmit herewith the second report of the Board of Engineers on the proposed bridge of the Ohio Connecting Railway Company, this Board having been reconvened by Special Orders No. 74, current series, from the headquarters of the Corps of Engineers.

The documents relating to the bridge in question, which were received with your letter of the 19th ultimo, are herewith returned, the maps being in a separate roll.

Respectfully, your obedient servant,

WM. E. MERRILL,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
October 18, 1887.

Respectfully submitted to the Secretary of War, inviting attention to the accompanying report of the Board of Engineers, reconvened, with the sanction of the War Department, by Special Orders No. 74, Headquarters Corps of Engineers, current series, to assemble at Pittsburgh, Pa., to consider and report upon new plans submitted by the Ohio Connecting Railway Company for their proposed bridge across the Ohio River near Pittsburgh, Pa.

After due examination and consideration of the maps and plans presented by the railway company the Board were unanimously of the opinion "that a bridge built upon the proposed location and plans would be acceptable and satisfactory to all interests."

The Board state, however, that "the construction of a bridge upon the proposed plans will not meet all of the requirements of the general law governing the bridging of the Ohio River; but, owing to the peculiar location of the bridge, the Board are of the opinion that it will conform to the spirit of the law, and that the departures from some of its minor requirements are not such as to injuriously affect navigation, for the protection of which the law was framed. This opinion is also held by the parties who represented the river interests at the meeting of the Board."

The Board further state that "the proposed plans for a span 525 feet long between centers of piers and 507 feet clear water-way across the main channel of the river to the right of Brunot's Island" practically spans "the entire water-way of this branch of the river at low water." * * * "Over the left-hand channel, which is only run by tows when by accident they fail to make the right-hand channel, the plans provide for a span giving a clear water-way of 400 feet, which is deemed ample."

The plans submitted, however, contemplate only a height of 80 feet above low water, while the law requires an elevation of 90 feet above low water, but the Board are of "opinion that 80 feet height near Pittsburgh will give as much head-room in floods as 90 feet at Steubenville, owing to the fact that the extreme oscillation of the river at Pittsburgh is more than 10 feet less than it is at Steubenville, and they therefore think that the proposed reduction in height will not be an injury to navigation."

Finally, the Board recommend "the approval of the proposed bridge except in the matter of height, which should be left open until Congress has had time to act on the application of the Bridge Company" for a change of the law in this respect. In the event of the failure of Congress to authorize the proposed reduction in height the superstructure must of necessity be 90 feet above low water, as required by existing law.

The views of the Board are concurred in, and it is accordingly recommended that the company be informed that the plan and location of the bridge will be approved provided Congress, by appropriate legislation, authorizes a reduction of the height required for the superstructure to 80 feet above low water.

CHAS. W. RAYMOND,
Acting Chief of Engineers.

SECOND REPORT OF BOARD OF ENGINEERS.

OCTOBER 4, 1887.

The Board of Officers of the Corps of Engineers, constituted by Special Orders No. 60, Headquarters Corps of Engineers, current series, and reconvened by Special Orders No. 74, Headquarters Corps of Engineers, September 17, 1887, "to consider and report upon new plans submitted by the Ohio Connecting Railway Company for the proposed bridge across the Ohio River, near Pittsburgh, Pa.," would respectfully submit the following report:

The Board met at Pittsburgh on the 4th of October, at the call of the senior member, and held a public session in the Monongahela House.

At this session the railway company was represented by their chief engineer and his assistants, and the river interests were represented by a number of the leading coal operators.

The maps and plans presented by the railway company were examined and discussed by those present, and it was their unanimous opinion that a bridge built upon the proposed location and plans would be acceptable and satisfactory to all interests.

The construction of a bridge upon the proposed plans will not meet all of the requirements of the general law governing the bridging of the Ohio River; but, owing to the peculiar location of the bridge, the Board are of the opinion that it will conform to the spirit of the law, and that the departures from some of its minor requirements are not such as to injuriously affect navigation, for the protection of which the law was framed; this opinion is also held by the parties who represented the river interests at the meeting of the Board.

The proposed plans provide for a span 525 feet long between centers of piers and 507 feet clear water-way across the main channel of the river to the right of Brunot's Island, thus practically spanning the entire water-way of this branch of the river at low water. The piers are about parallel to the direction of the current at low water, making a slight angle at higher stages. The 7 feet in excess of the 500 required by law is deemed sufficient to compensate for the slight obliquity of current at the higher stages. Over the left-hand channel, which is only run by tows when by accident they fail to make the right-hand channel, the plans provide for a span giving a clear water-way of 400 feet, which is deemed ample. The spans between the two channel-spaces, as proposed by the plans, are to be deck-spans. Owing to the facts that the left-hand channel is what might be termed an accidental channel, only occasionally used, and that the right-hand channel is narrower above the bridge location than the channel-span, the Board do not deem it important to require that the minor spans of the bridge should be through spans; they are also of the opinion that across the higher part of the island, say for a distance of about 600 feet, the construction of an embankment would not be objectionable to the interests of navigation.

The general bridge law requires that all bridges across the Ohio River above the mouth of the Big Sandy River shall be 90 feet above low water. The plans under consideration contemplate a bridge giving a clear height of 80 feet above low water, or 10 feet less than required by law, and the representatives of the river interest state that they are content with this reduced height.

The Board are of the opinion that 80 feet height near Pittsburgh will give as much head-room in the floods as 90 feet at Stubenville, owing to the fact that the extreme oscillation of the river at Pittsburgh is more than 10 feet less than it is at Steubenville, and they, therefore, think that the proposed reduction in height will not be an injury to navigation. Under these circumstances they are in favor of an 80-foot bridge at this locality, but in view of the positive requirements of the Ohio River bridge law, that bridges in this part of the river shall have a height of 90 feet, they do not see how the War Department can approve of the proposed height without additional legislation. As the Bridge Company has announced its intention of asking for such legislation, the Board would recommend that the War Department give the Bridge Company their support and co-operation in endeavoring to secure from Congress the privileges desired.

In conclusion, the Board would recommend the approval of the proposed bridge, except in the matter of height, which should be left open until Congress has had time to act on the application of the Bridge Company; it is evident that a failure of Congress to authorize the proposed reduction in height will necessarily compel the raising of the superstructure to a height of 90 feet above low water.

Respectfully submitted.

WM. E. MERRILL,
Lieut. Col. of Engineers.
J. W. BARLOW,
Lieut. Col. of Engineers.
AMOS STICKNEY,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., June 1, 1888.

SIR: I have the honor to submit the accompanying plans and papers pertaining to the proposed bridge of the Ohio Connecting Railway Company across "the Ohio River from the south shore to the north shore thereof at a point about one-half mile south of the mouth of Cork's Run, in Allegheny County, Pennsylvania," provided for by "an act to authorize the construction of the Ohio Connecting Railway Company Bridge," approved May 14, 1888, and to state that upon measurement the main channel-span is found to be 525 feet from center to center of piers, and the piers to be 18 feet in thickness on the low-water line; deducting therefor 9 feet from each of the piers—18 feet—the clear width of the main-channel span is 507 feet, as required by the act. The back-channel span, adopting the same method of measurement, is found to be 416 feet from center to center of piers, from which deducting 16 feet for width of piers, leaves 400 feet clear width, as required by law.

The plan also shows the bridge to be 80 feet above low water to the lowest part of the superstructure of the bridge, which is also in accordance with the requirements of the act.

It is accordingly recommended that the plan as submitted be approved.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.
(Through the Acting Judge Advocate General, U. S. Army.)

[First indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., June 4, 1888.

Respectfully forwarded to the Secretary of War, with instrument (prepared in duplicate) for his approval of the plans of the proposed bridge of the Ohio Connecting Railway Company across the Ohio River at the mouth of Cork's Run, Allegheny County, Pa.

There is no extract from the company minutes showing the names of the present officers of the company with the papers. With this exception, the papers required by the War Department circular of July 31, 1886, are complete.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, June 19, 1888.

SIR: I have the honor to return one copy of an instrument indicating the approval by this Department of the plans and location, as shown on the accompanying map, of the bridge authorized to be constructed by the "Ohio Connecting Railway Company" over the Ohio River near the mouth of Cork's Run, Allegheny County, Pa., under the act of Congress approved May 14, 1888.

Very respectfully,

WILLIAM C. ENDICOTT,
Secretary of War.

Mr. M. J. BECKER,
Chief Engineer Ohio Connecting Railway Company, Pittsburgh, Pa.

W W 20.

BRIDGE OF THE GEORGIA PACIFIC RAILWAY COMPANY ACROSS THE TOMBIGBEE RIVER AT WAVERLY, MISSISSIPPI, AUTHORIZED BY ACT OF CONGRESS OF MARCH 3, 1887. [THE ACT OF APRIL 2, 1888, CHANGES THE NAME OF THIS COMPANY TO RAILWAY INSTEAD OF RAILROAD.]

THE GEORGIA PACIFIC RAILWAY COMPANY,
Birmingham, Ala., May 16, 1888.

DEAR SIR: As you are aware there has already been approved by the War Department the plans for the erection of a draw-bridge by this company crossing the Tombigbee River at Columbus, Miss. We have now in contemplation a change of route which has in view the crossing of the Tombigbee River at a point 9 miles above Columbus known as Waverly. Should this line be adopted, we presume the Department will consider the necessity of our still building the drawbridge, although no boats have ascended the river beyond the point of contemplated bridge site in the past four years. We have therefore prepared plan for a bridge giving 220 feet draw, which we respectfully submit for approval.

You will find appended to the papers herewith an agreement (in duplicate) executed by the president of this company, which agreement is similar to the one heretofore executed by him in the matter of our proposed bridge across Tombigbee River at Columbus. I learn from the president that the information required by the War Department as to the directors and officers of this company for the current year, and as to the acceptance by this company of the several acts of Congress mentioned in the agreement, has been heretofore furnished, and is now filed with the papers pertaining to the bridges already authorized. This has been done in order to save time in the transmission of the papers back and forth, the necessities of our construction being urgent. We would therefore ask that you give this matter your earliest convenient attention.

Yours, truly,

I. Y. SAGE,
General Manager.

CHIEF OF ENGINEERS, U. S. A.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 23, 1888.

Respectfully submitted to the Secretary of War.

Plans for a bridge across the Tombigbee River at Columbus, Miss., submitted by the Georgia Pacific Railway Company, were approved by the Secretary of War April 28, 1888, as will appear from the papers herewith. The railway company now contemplates a change in the *location* of its proposed bridge from Columbus, Miss., to Waverly, a point on the river 9 miles above, and asks for the approval of the War Department thereof. The plan submitted covers the whole of the water-way of the river with its draw-spans, which, as nearly as can be ascertained from the drawings, are of sufficient width for the purposes of navigation at the proposed new location.

The act of March 3, 1887, providing for the construction of bridges across the Sunflower, Yazoo, and Tombigbee rivers, authorizes the Georgia Pacific Railway to build bridges "at such points as may hereafter be selected by said railway company for crossing said rivers with its railroad line, the said bridges to be so constructed as not to interfere with the navigation of said rivers," and it is assumed that under this provision the railway company may change the location of the proposed bridge, the plans already approved having been first canceled.

The information already furnished by the company in accordance with the requirements of the rule of the War Department dated July 31, 1886, will, it is supposed, suffice in the case of the bridge now proposed.

Previous papers herewith.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT, *May* 26, 1888.

Respectfully referred to the Acting Judge-Advocate-General to prepare the approval in duplicate, which will be drawn so as to annul the former authority granted April 28, 1888.

By order of the Secretary of War.

SAM'L HODGKINS,
Acting Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington D. C., June 1, 1888.

Respectfully returned to the Secretary of War, with instrument (prepared in duplicate) for approval of plans of a bridge across the Tombigbee River, Mississippi, drawn so as to annul the authority granted April 28, 1888.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER OF JOHN W. JOHNSTON, PRESIDENT OF THE GEORGIA PACIFIC RAILWAY COMPANY.

THE GEORGIA PACIFIC RAILWAY COMPANY,
Birmingham, Ala., June 13, 1888.

SIR: I beg to acknowledge your esteemed favor of June 4, inclosing an instrument, in duplicate, indicating approval by the Secretary of War of amended design and location for our Tombigbee River Bridge. I have executed these papers, and now return the same herewith to the Department for completion. I beg to add that the approved plans for the bridge over the Tombigbee, at Columbus, were returned to the Secretary of War for cancellation by registered letter dated May 31.

Hoping to receive, at an early day, our copy of the perfected papers, as above, I have the honor to be,

Very respectfully, your obedient servant,

JNO. W. JOHNSTON,
President.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, June 20, 1888.

SIR: I have the honor to return one copy of an instrument indicating the approval by this Department of the plans and location of a proposed bridge, to be constructed by the Georgia Pacific Railway Company across the Tombigbee River at Waverly, Miss.

Very respectfully,

WILLIAM C. ENDICOTT,
Secretary of War.

JOHN W. JOHNSTON, Esq.,
President Georgia Pacific Railway Company,
Birmingham, Ala.

W W 21.

BRIDGE OF THE MEMPHIS AND CHARLESTON RAILROAD COMPANY ACROSS THE TENNESSEE RIVER AT CHATTANOOGA, TENNESSEE, AUTHORIZED BY ACT OF CONGRESS OF FEBRUARY 28, 1887.

KNOXVILLE, TENN., *January* 30, 1888.

SIR: Under an act of Congress, approved February 28, 1887, entitled "An act to authorize the construction of a bridge across the Tennessee River at or near Chattanooga, Tennessee," the Memphis and Charleston Railroad Company is authorized to construct and maintain a bridge and approaches thereto over the Tennessee River at or near Chattanooga, in Hamilton County, Tenn. In conformity to the requirements of section 4 of said act, I send you by Southern Express, for your examination and approval, a map of the river 1 mile above and below the proposed site, showing the location of the proposed bridge, course of the river, currents, contour lines, etc.

Yours, respectfully,

C. H. HUDSON,
General Manager Memphis and Charleston Railroad.

The Hon. SECRETARY OF WAR.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
February 4, 1888.

Respectfully referred to Lieut. Col. J. W. Barlow, Corps of Engineers, for examination and early report.

By command of Brigadier-General Duane.

JAS. C. POST,
Major of Engineers.

[Second indorsement.]

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., March 10, 1888.

Respectfully returned to the Chief of Engineers.

It is believed that the interests of navigation, taking into consideration the probable future commerce on the Tennessee River, require all draw-bridges to have a clear opening on each side of the pivot-pier of at least 160 feet, and as this length has been adopted for several other bridges now contemplated, I respectfully recommend that the same be required in this case, and that it be made the ruling length in all bridges hereafter built across this river.

I would also recommend that the lowest part of the superstructure shall be not less than 70 feet above low water. This is the height the drawing indicates, though the figures are not stated.

I also recommend that the length of the fixed spans be increased so as to give at least 175 feet clear space between piers at the ordinary stage of water, and that no riprap or other obstructions be allowed about the bases of piers. This latter modification, it is thought, will not materially increase the cost of the bridge, as the number of spans and piers will be reduced.

It will be observed that no current observations, except at near low water, are shown on the map presented by the railroad company.

The engineer of the company explains that during and since the taking of his observations the river has not reached a height which would cause any considerable variation in the direction of the currents from those shown. This is probably the fact, as the banks for some distance above and below the proposed site are nearly straight and parallel, and no deviations in the current are likely to occur until after the river leaves its banks. I would therefore suggest that the requirement of current observations at all stages be waived in this case. The location of the bridge is satisfactory, and also that of the piers if modified in accordance with the recommendations above stated.

J. W. BARLOW,
Lieut. Col. of Engineers.

LETTER OF THE SECRETARY OF WAR TO MR. C. H. HUDSON, GENERAL MANAGER MEMPHIS AND CHARLESTON RAILROAD COMPANY.

WAR DEPARTMENT,
Washington City, March 19, 1888.

SIR: I have the honor to acknowledge the receipt of your letter of the 30th of January last, inclosing, for examination and approval, a map showing the plan and location of the bridge which the Memphis and Charleston Railroad Company proposes to construct across the Tennessee River at or near Chattanooga, Tenn., under the authority conferred by the act of Congress approved February 28, 1887.

In reply, I beg to invite attention to the inclosed report of the 15th instant on the subject, from the Acting Chief of Engineers, and to the accompanying copy of a report of the 10th instant from Lieut. Col. J. W. Barlow, Corps of Engineers, who recommends that a clear opening on each side of the pivot-pier of at least 160 feet be required in this case; that the lowest part of the superstructure be not less than 70 feet above low water, and that the length of the fixed spans be increased so as to give at least 175 feet clear space between piers at the ordinary stage of water, these recommendations being concurred in by the Acting Chief of Engineers.

I beg to request, as suggested by the Acting Chief of Engineers, that the plans be modified so as to conform to the views of Colonel Barlow, and that they be submitted in duplicate.

I also inclose a copy of Department rule of July 31, 1886, which is required to be observed when application is made for approval by the Secretary of War of plans for bridges.

Very respectfully, your obedient servant,

WILLIAM C. ENDICOTT,
Secretary of War.

MR. C. H. HUDSON,
General Manager Memphis and Charleston
Railroad Company, Knoxville, Tenn.

LETTER OF MR. C. H. HUDSON, GENERAL MANAGER MEMPHIS AND CHARLESTON RAILROAD COMPANY.

EAST TENNESSEE, VIRGINIA AND GEORGIA RAILWAY CO.,
OFFICE OF GENERAL MANAGER,
Knoxville, Tenn., May 19, 1888.

SIR: I have the honor to acknowledge the receipt of yours of March 19, and in response thereto I beg to submit herewith, in duplicate, modified plans for the proposed bridge of the Memphis and Charleston Railroad across the Tennessee River near Chattanooga, Tenn. After further and careful consideration of the location, however, it has seemed to us that the length of span recommended by Colonel Barlow is somewhat greater than is necessary, and greater than would be economically employed to cover the space, besides making the bridge proper longer than would be needed from the contour of the ground. The plan, as herewith returned, shows 270 feet between piers, instead of 275 as recommended, thus making the total length of the bridge less, and at the same time, as we believe, reducing the cost per foot of the structure a trifle. It is our desire to conform to the wishes of the Department, but we have believed that the results desired by them are attained in this plan, and we would respectfully ask that the matter be considered. I have the honor also to transmit a certified copy of the act of incorporation of the Memphis and Charleston Railroad; a certified copy of the original minutes of the same company, showing the original organization, location of the first board of directors, etc.; also, a certified list of the officials of the same company; also certified copy of the resolution of the board of directors accepting the provisions of the act of Congress authorizing the proposed bridge.

Yours, respectfully,

C. H. HUDSON,
General Manager.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

[Indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 28, 1888.

Respectfully referred to Lieut. Col. J. W. Barlow, Corps of Engineers, for examination and early report.

* * * * * * *

All of the papers to be returned.
By command of Brigadier-General Duane.

JAS. C. POST,
Major of Engineers.

[Indorsement.]

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., June 13, 1888.

Respectfully returned to the Chief of Engineers.

Upon further consideration, I am of the opinion that the lengths of the fixed spans can be established at 270 feet, in the clear, without detriment to the interests of navigation. When consulting in March last with the engineer of the Memphis and Charleston Railroad Company having this bridge matter in charge, I deemed that 275 feet was desirable. It was then thought that the said engineer acquiesced in a span ot 275 feet length, but as there is apparently some misunderstanding in reference thereto (the 275 feet having been understood by the engineer as "between pins" instead of between piers), and more particularly as the proposed bridge is to be constructed above Chattanooga, which city may be reasonably considered as the head of navigation of the Lower

Tennessee River boats, I respectfully recommend for adoption the several distances as follows:

	Feet.
Height of lowest part of superstructure above low water	70
Clear width of opening between piers on either side of draw-pier, at 10 feet above low water	160
Clear width between piers of fixed spans, at 10 feet above low water	270

as shown on the Government gauge at Chattanooga, and that no riprap or other obstructions be placed about the bases of the piers.

Upon the maps (blue prints) submitted the horizontal distances are given on the line of extreme high water of 1867; these should be on a line 10 feet above zero.

With the concurrence of the general manager, Mr. C. H. Hudson, I have indicated on the blue prints the lines and distances above referred to. These distances do not accord exactly with the scale of the drawing, but should govern in the construction of the bridge.

Having reference to my indorsement of March 10, the length of fixed span recommended should read 275 feet, and not 175 feet, as stated by clerical error.

J. W. BARLOW,
Lieut. Col. of Engineers.

[Indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
June 20, 1888.

Respectfully returned to the Secretary of War, through the Acting Judge-Advocate-General, U. S. Army, inviting attention to the accompanying report of Lieut. Col. J. W. Barlow, Corps of Engineers, dated the 13th instant, whose views and recommendations as given therein are concurred in by this office.

It will appear that he recommends that the height of the lowest part of the superstructure of the bridge above low water be 70 feet; that the *clear* width of opening between piers on either side of the draw-pier, at 10 feet above low water, be 160 feet, and that the *clear* width between piers of fixed spans, at 10 feet above low water, be 270 feet, and also that no riprap or other obstruction be placed about the bases of the piers.

With the concurrence of General Manager Hudson, Colonel Barlow has indicated on the blue prints giving plan and location of the bridge the lines and distances above referred to, which, however, while not according exactly with the scale of the drawing, should govern in *the construction of the bridge.*

The papers required by the rule of the War Department of July 31, 1886, are herewith.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[Indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., June 22, 1888.

Respectfully forwarded to the Secretary of War, with formal instrument (prepared in duplicate) for his approval.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

LETTER OF THE WAR DEPARTMENT TO C. H. HUDSON, ESQ.

WAR DEPARTMENT,
Washington City, July 12, 1888.

SIR: I have the honor to transmit herewith for retention by your company a copy of an instrument, duly executed by the Secretary of War, approving the plan and location of a proposed bridge over the Tennessee River at or near Chattanooga, Tenn., to be constructed by the Memphis and Charleston Railroad Company in accordance with the act of Congress approved February 28, 1887.

Very respectfully,

SAML. HODGKINS,
Acting Chief Clerk.

Mr. C. H. HUDSON,
General Manager Memphis and Charleston Railroad.
Knoxville, Tenn.

W W 22.

BRIDGE OF THE KANSAS CITY AND MEMPHIS RAILWAY AND BRIDGE COMPANY ACROSS THE MISSISSIPPI RIVER AT MEMPHIS, TENNESSEE, AUTHORIZED BY ACT OF CONGRESS OF APRIL 24, 1888.

[Morison & Corthell, consulting and constructing engineers.]

CHICAGO, *May* 5, 1888.

SIR: In accordance with the request of Mr. Geo. H. Nettleton, president Kansas City and Memphis Railway and Bridge Company, we present in person, by the hands of our Mr. Corthell, for your approval, the maps, plans, and papers relating to a proposed bridge over the Mississippi River at Memphis, Tenn.

These documents are as follows:

(1) Articles of incorporation of the Kansas City and Memphis Railway and Bridge Company.

(2) Copy of minutes of a meeting of incorporators and directors of the Kansas City and Memphis Railway and Bridge Company.

(3) Extract from the minutes of a meeting of the incorporators and directors of the Kansas City and Memphis Railway and Bridge Company, showing the officers of said company.

(4) Copy of proceedings of the board of directors of the Kansas City and Memphis Railway and Bridge Company, accepting the provisions of the act of Congress entitled "An act to authorize the construction of a bridge across the Mississippi River at Memphis, Tennessee," approved April 24, 1888.

(5) Kansas City and Memphis Railway and Bridge Company submitting to the honorable Secretary of War, map, designs, and papers as required by rule established by the honorable Secretary of War July 31, 1880.

(6) Kansas City and Memphis Railway and Bridge Company authorizing Messrs. Morison & Corthell to present plans and papers to the honorable Secretary of War.

(7) A map, in duplicate, of the river at the location of the proposed bridge, with soundings, current-lines, shore-lines, topography, etc., as required by the act of Congress.

(8) A plan, elevation, and sections, in duplicate, of the proposed bridge, showing the clear width of spans and the clear height of the superstructure above high water, as required by the act of Congress.

We desire to call your attention to the fact that the act of Congress requires three spans of certain minimum lengths. These three spans occupy the entire width of the river. The order of these three spans is also definitely determined as we understand it. We have therefore had no choice in making the arrangement and lengths of spans, but have conformed the plans submitted to the exact requirements of the act of Congress, no other design being admissible.

As it will require considerable time to perfect the plans of the superstructure of this bridge, which will be one of the largest in some respects in the world, with peculiar and somewhat difficult conditions imposed by the act of Congress, we respectfully request the privilege of revising the superstructure design should further study show it to be necessary in order to comply with the requirements of economy and stability, it being understood, however, that the clear width and clear height as shown on the plans now submitted shall not in any case be changed.

We present these plans at this early date as it is of great importance to commence the work of construction at once in order to take advantage of the next season of low water in the river. It will require some little time to obtain the material for the foundations, and we wish to have the orders for it given as soon as possible. This we can not do until you have approved the plans now submitted.

We therefore respectfully request that your approval be given as soon as practicable.

We are, sir, yours, respectfully,

MORISON & CORTHELL,
Engineers,
Per E. L. CORTHELL.

HON. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
May 9, 1888.

Respectfully returned to the Secretary of War.

The within plans appear to be, upon examination, in accordance with the requirements of "An act to authorize the construction of a bridge across the Mississippi River at Memphis, Tennessee," approved April 24, 1888, and with the view to further compliance with its provisions, it is recommended that they be referred for consideration of a Board of Engineers, to consist of the following-named officers: Lieut. Col. W. E. Merrill, Maj. O. H. Ernst, Capt. D. C. Kingman, with Lieut. C. E. Gillette as recorder; the Board to meet at Memphis, Tenn., upon the call of the senior member, as soon as practicable, due notice being given through the public press of the time and place of the meeting. With the sanction of the Secretary the order convening the board will be issued from this office.

J. C. DUANE,
Brig. Gen., *Chief of Engineers.*

[Second indorsement.]

WAR DEPARTMENT,
May 10, 1888.

The recommendation of the Chief of Engineers is approved.

The Board will be instructed to require that all objections be presented in writing.

By order of the Secretary of War.

SAMUEL HODGKINS,
Acting Chief Clerk.

[Third indorsement.]

WAR DEPARTMENT,
July 10, 1888.

A majority of the Board of Engineers reports that the main span of the bridge on the Memphis side of the river should be 1,000 feet in length; that the other two spans should be 600 feet in length, and the whole structure should be 75 feet above high water.

Upon a careful examination of the evidence in this case, and the peculiar methods of navigation by tows, it appears that the minimum width of 700 feet for the main span named in the act of Congress is more than ample and sufficient for all kinds of navigation on the river except the tows, which, of different lengths varying from 660 to 900 feet, pass down the main channel controlled by a single steam-boat.

The usual length of these tows is 780 feet and the width 205 feet, and in one instance a tow of 1,032 feet in length is reported.

When these tows are in line and under control they would have no difficulty in passing a bridge much less than 700 feet in width; but occasionally, under existing methods, they can not be thus controlled, and may float down side on or, in other words, lengthwise across the stream. In this condition guidance is impossible, and it is difficult to see how any practicable length of span could insure safety. The obvious provision against such an accident is to increase the controlling power and insure safe guidance from the start, or to reduce the length and size of the tows. It may also be observed that a tow, thus floating helplessly down at right angles to the current, would be a serious and dangerous obstruction to all other methods of river navigation.

While the rights of navigation in navigable rivers are to be jealously guarded and protected, the right to cross such streams by bridges to transport freight and passengers can not be disregarded. There must in such cases be mutual concession and such adjustments in the methods of transportation on the stream and in the construction of bridges over it, that the privileges of both may be enjoyed and preserved.

To require such extreme length of bridge on the one hand as would permit navigation by tows in the same manner as if there was no bridge, would be as unreasonable as to construct the bridge in such a manner as practically to destroy all transportation by tows.

I am unable, therefore, to approve this report so far as the width of the main channel-span is concerned.

It appears that the width of the river at the site selected and approved by the Board is 1,970 feet at low water. The width of the proposed piers is about 20 feet each. The minimum length of the main channel-span is fixed by law at 700 feet and the other two spans at 600 feet each, to which add 40 feet for the width of the two piers, we have 1,940 feet, or 30 feet less than the width of the river at low water. One span 730 feet long and two spans 600 feet long in the clear will make, with 40 feet for the width of two piers, a bridge 1,970 feet long. It is better to add the 30 feet to the main span, rather than divide it between the shorter spans.

Plans may be submitted by the railway and bridge company giving a main channel-span on the Memphis side of the river 730 feet long in the clear at low water, and two other spans 600 feet long in the clear at low water, the end piers to be placed at low water on either shore, so that the three spans will cover the entire width of the river at low water. All the necessary aids to navigation in passing under the bridge can not now be determined, but the railway and bridge company may consider the question of a guiding pier, with proper guards to the bridge pier on the Memphis side, for protection to navigation, or that of placing the pier on the Memphis side in 9 feet of water at the highest stage, making the long span 770 feet.

The law requires that the bridge shall be so constructed as to provide for the passage of wagons and vehicles of all kinds and for the transit of animals.

Drawings must be submitted in compliance with the law, showing a cross-section of the bridge and the roadways proposed.

WILLIAM C. ENDICOTT,
Secretary of War.

REPORT OF BOARD OF ENGINEERS.

MEMPHIS, TENN., *May* 26, 1888.

SIR: The Board of Officers of the Corps of Engineers, U. S. Army, convened by Special Orders No. 26, dated Headquarters Corps of Engineers, U. S. Army, Washington, D. C., May 10, 1888, to examine and report upon the plans of the proposed bridge across the Mississippi River at Memphis, Tenn., submitted by the Kansas City and Memphis Railway and Bridge Company, would respectfully submit the following report:

Before entering upon the details of the proposed bridge it is advisable to describe the locality.

The city of Memphis is situated on a bluff on the left bank of the Mississippi River, at the confluence of Wolf River, and has a water-front on the Mississippi of about 3 miles, beginning at the mouth of Wolf River and extending to near the head of President's Island. At this island the river divides into two channels of nearly equal size. The western channel was the main channel until within the last two years, since which time the best water has been found in the eastern channel, though the difference between the two in navigability is not great.

On the shore opposite Memphis is the small village of Hopefield, mainly occupied by persons employed at the railroad transfer boats.

Above the city there is a sharp bend in the river whose apex is about 4 miles above Wolf River. From this bend the current sets directly towards the Memphis shore, with a strong scour against the upper side of the Hopefield peninsula. Since 1877 half a mile in width of the point of this peninsula has washed away, and the present point is about a mile further down-stream than was the case eleven years ago. Formerly the current struck the left bank above the mouth of Wolf River, and followed the Memphis front tangentially. As the point of impact moved down-stream the angle of the current with the Memphis shore became more nearly a right angle, and the scouring effect on the bank became so great that expensive works of protection had to be built along a large part of the city front. To prevent this condition from getting worse it was also necessary to revet the upper side of the Hopefield peninsula. The Memphis revetment extends over about 2 miles of the city front, and has been very successful, but should be continued to the lower end of the bluffs. The Hopefield revetment extends over a distance of about 2½ miles, and ought to have been carried to the point, a further distance of about a mile, but it was necessarily stopped by lack of funds.

In passing the front of Memphis a floating object comes out of the Hopefield Bend heading straight for the upper end of the city wharf;

it is then deflected to the right by the current, turning an angle of 100 degrees while passing the main part of the city, and turning another angle of about 25 degrees to the left while passing into the eastern or Tennessee chute of President's Island. Should it, however, be drawn into the western or Arkansas chute, it would turn an angle to the right of about 90 degrees.

This is the course that all river craft must follow as they pass the city of Memphis, and the excessive curvature in a short distance, with its accompanying whirls and boils, is the reason why this part of the river is always dreaded by navigators. We have been informed that coal tows never attempt to run Memphis at night, and we know that the only tow of coal that passed Memphis while the Board was in session, towed by the *W. W. O'Neil*, laid up all night at a point above the mouth of Wolf River, although the stage of the river was only about 23 feet on the gauge, high water being 35.3 feet on the same gauge.

On the other hand, we are informed by Captain Haarstick, president of the Mississippi Valley Transportation Company, that his tows, which are chiefly used to carry grain, flour, and merchandise, are forced by competition to run night and day, and that their pilots have standing orders to "flank" all sharp bends of the river, in which class the bend at Memphis is one of the chief.

Accompanying this report are two diagrams, showing the actual positions at short intervals of several tows while passing the Memphis Bend, which indicate the method of "flanking" bends more clearly than can be described in words. These diagrams were furnished by officers of the Mississippi River Commission. It will be noted, however, that they refer to stages below high water, at which times the current of the river is considerably reduced, and the difficulty of flanking the bends is proportionately lessened.

In accordance with the requirements of the acts of Congress authorizing the construction of this bridge, the engineers of the bridge company made current observations at the proposed site, and found the following velocities in the part of the river to be covered by the eastern or Tennessee span of the proposed bridge:

Gauge-reading:	Miles per hour.
35 feet	8.34
24.80 feet	6
20.50 feet	6

The reading on the Memphis gauge of local highest water is 35.3 feet.

The Board met at Memphis on the 24th instant, and on that day and the 25th held public sessions in the United States Engineer Office, and heard all parties who desired to present their views. They also inspected the entire front of Memphis from the head of the Hopefield revetment to the head of President's Island, and floated along the city front with the boat in the position occupied by tows in flanking the Memphis Bend, the boat being under the control of one of the pilots of the Mississippi Valley Transportation Company.

In accordance with the special instructions to the Board, all parties who presented themselves were requested to give their views in writing, and all such statements and all letters received are appended to this report. No communication was received from the Coal Exchange of Pittsburgh, or from any coal operator. The only representations of the Ohio River coal interests who put in an appearance were two pilots, who belonged to a tow returning up-stream, which happened to reach Memphis while the Board was in session.

After careful consideration of the facts before it, the Board has come to the unanimous conclusion that the site selected by the bridge engineers is the best that there is along the Memphis Front for the construction of a bridge, and that the clear height of 75 feet above highest water is all that should be required. The river interest is unanimous in requesting that the channel-span be placed next to the Tennessee shore, and the Board fully agrees with this view. It was also the opinion of the river-men that the shore-pier on the Tennessee side should be at or near high-water mark, so that this pier might be out of water, and the shore be run as if no pier were there. The Board recommends that this pier be placed where it will be in 9 feet of water at the highest stage, because the barges that run at such stages draw 9 feet, and are therefore no more apt to hit the pier than the shore; moreover, 9 feet at extreme high water means less than 9 feet at ordinary high water, and it is deemed necessary to keep the outer channel-pier as far out in the river as circumstances will admit.

The serious and difficult question before the Board is the clear width of water-way to be given under the channel-span. Major Ernst and Captain Kingman are in favor of a clear water-way of 1,000 feet, for the following reasons:

The proposed location of the bridge, while perhaps as favorable as any that can be found within a reasonable distance from Memphis, is one that presents peculiar difficulties for the accommodation of navigation. All of those persons who have appeared before the Board in the defense of the navigation interest have declared that at this point it would frequently be necessary for heavy tows to pass under the bridge "broadside on;" that is, with the direction of their greatest length at right angles with the current and parallel with the bridge. As the velocity of the current at high water is frequently as much as 8½ miles per hour, there will often be great difficulty in "straightening out" before reaching the bridge, and sometimes this will be impossible. They think that the claim of the navigation interest in this respect is reasonable.

The length of the tows of grain barges is about 660 feet; that of coal tows is sometimes as much as 900 feet. In one case a length of 1,032 feet is reported. To accommodate a tow 900 feet long a clear width of channel-way of 1,000 feet between piers will afford but scant margin. That width will afford only a safe margin for the more valuable tows of grain barges, which measure 660 feet in length. It is the width asked for by the navigation interest unanimously, and it should, in the judgment of the officers mentioned, be accorded.

The completion of the revetments in Hopefield and Memphis bends is essential to the preservation of a state of affairs even as favorable as that which now exists, as will be explained further on. No improvement is to be expected, but if for any reason the revetment should not succeed in preventing further movement of the Memphis Bend, the approach to the proposed location of the bridge will become less and less favorable as time advances. Any doubt as to the proper length of span should therefore be thrown in favor of the greater length.

An increase of the water-way from 700 to 1,000 feet will no doubt increase the cost of the bridge, but even thus the cost may be much less than the sums expended upon some other bridges in the country, and it need not be prohibitory.

The Board has therefore to state that a majority of its members report the clear width of channel-way required at Memphis to be 1,000 feet.

The law requires that the side spans should not be less than 600 feet in length. In the judgment of the Board this provision is unnecessary, and could wisely be omitted in future laws for Mississippi bridges, as the great cost of piers in the Mississippi River compels the construction of side spans that must of necessity be wide enough for all ascending craft or for single boats descending the river, while all descending tows will of necessity take the channel. There is a positive objection to fixing the lengths of side spans by legislation, as the long channel-spans will almost necessarily be built on the cantilever system, and in such construction the length of the cantilever span fixes the length of the adjacent counterbalancing spans. Inasmuch as the law in the present case fixes the "other spans" at 600 feet, it is evident that the second span from the Tennessee shore must have this length. The third span will reach the Arkansas shore, and can not be made 600 feet over the water-way, as there is not water-way enough for a span of such length if the channel-space be 1,000 feet, the width of water-way at the selected crossing being but 1,970 feet, out of which must be deducted the widths of the piers. The last pier of the bridge should therefore be on the edge of the Arkansas bank.

It is recommended that the bridge company be required to protect the river banks for a reasonable distance above and below their bridge line, so as to preserve the present shore-lines and prevent the formation of water-ways behind the shore piers. It is thought that such protection should extend from a point about 300 feet above the line of the bridge to a point about 50 feet below. The bank between high and low water lines should be paved.

The Board is in serious doubt as to the expediency of permitting any bridge at all to be built in this stretch of river until it has received a fixed regimen. It is evidently vital to the navigation interests that the channel at the site of a bridge should be permanent; otherwise a change in channel might be an embargo to navigation. It therefore seems imperative that the work of fixing the river-front at Memphis should be completed, and this work seems essential whether the bridge be built or not.

The completion and strengthening of the revetment in Hopefield Bend and the continuation of the Memphis revetment to the lower end of the bluffs seem vitally necessary to the successful maintenance of a navigable channel at the site of the proposed bridge, and the Board desires that its approval of the construction of the proposed bridge shall be considered as contingent on the completion of this collateral work.

It is also the opinion of the Board that the proposed bridge, whatever its channel-span, would be in danger of becoming a menace to navigation in case the main channel of the river should return to the Arkansas side of President's Island. It is believed that the present favorable conditions should be assured by the construction of a sill across the Arkansas chute, and that any tendency for a return of the river to this chute should be vigorously repressed.

The river-work above named is remote from the bridge, and its character and conditions are such that it should be done at the expense of the United States.

Respectfully submitted.

O. H. ERNST,
Major of Engineers.
DAN. C. KINGMAN,
Captain of Engineers.
CASSIUS E. GILLETTE,
First Lieut. of Engineers,
Recorder.

The CHIEF OF ENGINEERS. U. S. A.

The above report expresses my views in every particular except as to length of span. On this point I am of the opinion that a channel space of 700 feet in the clear, with one pier resting on the shore, so that the shore itself will serve as a guiding dike to lead into the channel space is equivalent in safety to a channel space from 100 to 200 feet wider not placed near the shore. I therefore hold that 700 feet of clear water-way, placed as proposed, is equivalent to about 850 feet placed away from the shore, as is usually the case. As the last-named length is 350 feet greater than the channel space provided by the bridges over the Ohio at Henderson and Cairo for the same coal tows that pass Memphis, I consider a channel space of 700 feet adjacent to the Tennessee shore as affording ample accommodation to coal-fleets, and I believe that whatever will answer their requirements will necessarily meet those of the Mississippi Valley Transportation Company.

The bridge location is 3 miles below the mouth of Wolf River and about 1,000 feet below the point at which the curve along the Memphis Front connects with the reverse curve that passes east of President's Island. All tows that pass the lower end of Memphis ought to be, and except in case of accident will be, in a position parallel with the shore before they reach the site of the bridge, and therefore they should experience no difficulty in passing through even a narrower space than 700 feet. It is certain that all diagrams of tows passing Memphis which the Board has been able to procure show that this statement is correct in the cases shown thereon. In my opinion this will always be the case, except when the machinery of the tow-boat becomes disabled just above the bridge and the tow drifts down at the mercy of the current. Such a casualty may never happen, and in view of the extraordinary difficulties of building any bridge at Memphis on account of the impossibility of reaching an incompressible stratum, on which to found the piers, and the rapid rate at which the cost of superstructure increases with an increase of span, it does not seem just to the great land-transportation interests, that also deserve consideration, to impose a greater burden than is necessary to meet the ordinary requirements of navigation. If machinery is deranged or stopped above a bridge there is no telling where the tow will land, and a 1,000-foot span may prove no safer than a 700-foot one. The latter is longer than any truss span thus far built in the world, and is only exceeded by the cantalever spans now constructing in Scotland over the Frith of Forth, where the absolute impractibility of intermediate piers made such enormous spans an unavoidable necessity. The latter site has, however, the great advantage over the Memphis site of having foundations of solid rock, either out of water or slightly submerged, or of bowlder clay as hard as rock, and at a moderate depth below water.

It is true that a suspension bridge might be built at this place, but engineers who make a specialty of bridge construction are so much opposed to suspension bridges for railroad purposes, for reasons that they consider satisfactory, that it does not seem right to force on them a kind of bridge which they consider inadmissible.

The fact that the great coal-shipping interest neither sent a representative to the meeting of the Board nor addressed them any communication whatever seems to show that it considers the minimum provisions of the law as satisfactory. [Since the above was written I have received a dispatch from a committee of the Coal Exchange requesting a channal span of 1,000 feet.] On the other hand, the Mississippi Valley Transportation Company operates a route where there never have been any bridges, and in the absence of experience they appear to exaggerate the difficulties and dangers of passing them.

WM. E. MERRILL,
Lieut. Colonel of Engineers.

SUPPLEMENTAL REPORT OF BOARD OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Galveston, Tex., June 3, 1888.

SIR: The Board of Engineers convened at Memphis, Tenn., by Special Orders 26, from Headquarters Corps of Engineers, dated May 10, 1888, to examine and report upon the plans of the proposed bridge across the Mississippi River at that place submitted by the Kansas City and Memphis Railway and Bridge Company, were unable to agree as to the proper width of channel-way which should be provided under the main span.

Before leaving Memphis they prepared a report, which they all signed, in which both the majority and minority views upon this point were briefly stated. Subsequently, when the members of the Board had returned to their stations, the senior member, who had the report in his custody and who was in the minority upon the point referred to, changed his mind as to the degree of elaboration which he thought his views should receive, and proposed to make some extensive alterations in the report, at the same time suggesting by mail to the majority that they might likewise make alterations. While the majority had been willing, out of courtesy to the minority, to admit his views to their report, so long as these views were moderately and briefly stated like their own, they could not permit the argument finally adopted by him to become part of their report. The time required to recall and reconstruct the original report could not well be taken, owing to the great distance apart of the members, and the fact that the report had already been called for by the War Department. The majority therefore consented by telegraph to the omission from the report, of the minority views, and to their being appended as a supplemental report, with the understanding that an opportunity should be given them to answer, in a further supplemental report, the argument of the minority.

It seems to them that a fuller statement of their side of the question should be made than was considered necessary in their original report, when the discussion of the question had not assumed a controversial character. They propose to make this statement in the form of an answer to the various points in the argument of the minority.

(1) The minority expresses the opinion that if a pier be placed upon the shore, so that the shore itself will serve as a guiding-dike, the channel-way adjoining the pier may be from 100 to 200 feet less in width than if the pier were out in the stream, without increasing the difficulties of passage.

Without expressing any opinion as to the accuracy of this estimate, the majority remark that it is not practicable to build a pier which shall occupy the position described at all stages of the river. The shore-line changes as the water rises and falls. A pier placed at or near the shore-line at high water is a long way from the shore-line at low water.

(2) From the above the minority concludes that a 700-foot channel-way near the shore is equivalent to 850 feet out in the stream, and that this being 350 feet greater than the channel-ways provided at Hender-

son and Cairo, upon the Ohio River, through which the coal tows pass, the latter should have no difficulty in passing a 700-foot space at Memphis; also that a space that will accommodate the coal tows will accommodate the grain tows; hence that a 700-foot space is sufficient.

Without commenting at length upon the facility with which 700 is transferred into a number 350 greater than 500, the majority remark that no comparison can be made between the Ohio River and the Mississippi River, particularly the Mississippi River at Memphis, with respect to the difficulties of navigation. The coal tows which have managed to get through the Henderson Bridge do not attempt to navigate the Memphis Bend at night even now, when there is no bridge. If they fear to pass at night through a free river, say, 1,900 feet wide, it is not a fair assumption that they can easily pass in daytime through a space 700 feet wide; at all events the two pilots who appeared before the Board from the coal tows then at Memphis, declared that they required 1,000 feet.

(3) The minority states that all tows which "pass the lower end of Memphis ought to be, and except in case of accident will be, in a position parallel with the shore before they reach the site of the bridge."

This is the pith of the entire subject. If this be true, than a 700-foot channel-way is sufficient. All of the river-men who appeared before the Board say that it is not true. The members of the majority have personally observed the manipulation of the heavy tows, and they are quite prepared to believe what the river-men tell them. That the tows will generally be straightened out may be granted. That they will sometimes be compelled to pass under the bridge "broadside on" has been proved to the satisfaction of the majority, and this notwithstanding that they be handled with all the skill that the best navigators possess and that all machinery and other appliances be in good order. The diagram submitted with the report of the Board show the positions of a few tows passing through Memphis Bend as they happened to pass upon the days of observation. Naturally the tows are shown in the positions which they generally occupy; that is, "straightened out" by the time they reach the site of the bridge. But these diagrams may be very misleading, for the reason that an idea is conveyed to the mind much more forcibly through the eye than through the ear. The diagrams were forwarded because they are an important part of the information collected, but the statement should be emphasized, that they represent only what is usual, and not by any means all that a bridge must provide for.

(4) The minority refers to the great difficulty of building a bridge at Memphis, on account of the compressibility of the soil upon which the piers must rest, to the rapid rate at which the cost of superstructure increases with an increase of span, and to the importance of placing no unnecessary obstacle in the way of the land transportation which desires to cross the river.

The Board had before it no estimate of what the 1,000-foot span would cost. The majority consider this a matter of secondary importance. They are thorough believers in the value and importance of land transportation, and they desire to see the bridge built. But they can not agree that the saving of a few hundred thousand dollars, or even millions, to the bridge company will justify placing in the stream an obstruction worse than those which the Government is now expending millions to remove. The soil upon which the piers must rest is not the best, but it is suitable for the support of heavy weights.

The practicability of building 1,000-foot spans has not been questioned. They can undoubtedly be built, and at a cost, in the judgment of the majority, much less than that of certain other bridges now in operation.

(5) From the fact that the great coal-shipping interest did not formally protest before the Board against the 700-foot channel-way provided as a minimum in the law, the minority concludes that that interest considers the 700-foot space sufficient.

The evidence of the two pilots engaged in the coal business has already been referred to.

They stated that 700 feet was not sufficient, and that they needed 1,000 feet. That the owners did not formally appear before the Board was a matter of surprise.

It was explained by the statement that an unexpected rise in the Ohio River had brought upon them a sudden rush of business. But whether they remained absent from good reasons or no reasons, it is not a fair assumption that they are content with 700 feet. They are merely the temporary users of a great public highway which is under the guardianship of the Government, and they might fairly presume that the War Department would protect that highway and would not accord to the opposing interest everything that was not prohibited by law. At all events the Government is not protecting merely the interests of those now engaged in river traffic. It is protecting the highway itself for the use of future generations as well as the present.

The neglect or indifference of the present coal operators is not good reasons for depriving posterity of the free use of a great river.

(6) The minority thinks that the Mississippi Valley Transportation Company exaggerates the difficulties and dangers of passing bridges because it operates a route which has heretofore been free of them. The able manager and the experienced navigators of that company, and those who know them, will be surprised to hear that they do not understand what their business requires. But the majority can judge for themselves in this matter. There are the tows of a given size approaching a given site in a given way. They are immense unwieldy masses, floating down an inclined surface in a current of 8½ miles per hour. How much space do they require to pass safely under the bridge?

A short trip upon one of the tows will enable any intelligent person to form an opinion upon the subject.

In conclusion, the majority reiterate their opinion that bad as the approaches to the proposed site of the bridge are now, they are likely to become worse, and can not become better, and that the clear width of channel-way required to prevent the bridge from being an unnecessary obstruction to navigation is 1,000 feet.

Very respectfully, your obedient servants,

O. H. ERNST,
Major of Engineers.
DAN. C. KINGMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER FROM MESSRS. MORISON & CORTHELL.

WASHINGTON, *August* 3, 1888.

SIR: On the 5th of May, 1888, in accordance with the request of Mr. George H. Nettleton, president of the Kansas City and Memphis Railway and Bridge Company, we presented to you at the hands of our

Mr. Corthell, for your approval, the maps, plans, and papers relating to the proposed bridge over the Mississippi River at Memphis, Tenn.

In conformity with the indorsement dated July 10, 1888, made by you on the report of the Board of Engineers, provided for in the act of Congress approved April 24, 1888, we now, by the hands of our Mr. Morison, present to you for approval a new plan, elevation, and section in duplicate, in conformity with the requirements of your indorsement of July 10.

We understand that all other papers are complete and meet with your approval.

We believe that this plan has been made in strict conformity with your opinion, and in behalf of the Kansas City and Memphis Railway and Bridge Company would request that an approval of this revised plan and of the location already made be given as early as is consistent with the rules of your Department.

We are, very respectfully, yours,

MORISON & CORTHELL.

HON. WILLIAM C. ENDICOTT,
Secretary of War.

[First indorsement.]

WAR DEPARTMENT, *August* 7, 1888.

Respectfully referred to the Acting Judge-Advocate-General to prepare the formal approval of plans submitted August 3, with the condition that the passage of wagons and vehicles of all kinds be provided for, as proposed by Mr. Morison in his letter of August 4.

The right to require changes in said structure, if the public interest demands them, being reserved to the Secretary of War in section 9 of said act.

By order of the Secretary of War.

SAM'L HODGKINS,
Acting Chief Clerk.

[Second indorsement.]

WAR DEPARTMENT,
JUDGE-ADVOCATE-GENERAL'S OFFICE,
Washington, D. C., August 9, 1888.

Respectfully returned to the Secretary of War, with draught of an instrument for his approval of the plans and map of location of a proposed bridge across the Mississippi River, containing conditions as directed in the preceding indorsement.

G. NORMAN LIEBER,
Acting Judge-Advocate-General.

W W 23.

REPORTS RESPECTING INTERFERENCES WITH NAVIGATION BY BRIDGES, CAUSEWAYS, AND OTHER STRUCTURES.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, December 18, 1885.

The Secretary of War has the honor to transmit to the United States Senate, in compliance with section 2 of the river and harbor act of July

5, 1884, a letter from the Chief of Engineers, dated the 12th instant, and its accompanying copies of reports from officers of the Corps of Engineers, relating to bridges, causeways, or structures now erected or in process of erection which do or will interfere with free and safe navigation.

WILLIAM C. ENDICOTT,
Secretary of War.

The PRESIDENT PRO TEMPORE OF THE UNITED STATES SENATE.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 12, 1885.

SIR: Section 2 of the river and harbor act of July 5, 1884, requires of the Secretary of War that—

> He shall also report [to Congress] whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstructions.

With the view of supplying the information desired, officers under the direction of this office were instructed to submit reports covering all facts necessary to enable the Secretary of War to comply with the terms of the extract above quoted. Reports have been received from officers in charge of river and harbor districts, and I have the honor to submit herewith copies of such of them as report instances of bridges, causeways, or structures now erected or in process of erection that do or will interfere with free and safe navigation, with recommendations as to the best mode of altering or constructing them as will prevent any such obstructions.

All other officers report that there are no instances in their respective districts of interference with free and safe navigation from the above-mentioned causes.

Very respectfully, your obedient servant,

JOHN NEWTON,
Chief of Engineers,
Brig. and Bvt. Maj. Gen.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

REPORT OF MAJOR CHARLES W. RAYMOND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., January 27, 1885.

GENERAL: In compliance with instructions contained in General Orders, No. 13, Headquarters Corps of Engineers, dated July 23, 1884, I have the honor to submit the following report with reference to obstructions to navigation in the district under my charge, as specified in sections 2 and 8 of the river and harbor act of July 5, 1884.

A sketch map* showing the location of bridges referred to in the report is also respectfully transmitted herewith.

* * * * * * *

A careful study has been made of all the bridges in the district. Those which interfere with free and safe navigation cross either the Fort Point Channel or Charles River (which enter the upper harbor of Boston), and are as follows:

(1) FORT POINT CHANNEL.

a. The New York and New England Railroad Bridge interferes with free and safe navigation. This arises from three causes.

(*a*) Its draw-openings are too narrow. The bridge is situated between the Congress Street and Mount Washington Avenue bridges (A and C on plan), being 500 feet from the first and 1,100 feet from the second. (See B on plan.) Its draw-openings are 40 feet 7 inches wide, being about 1 foot 7 inches narrower than those of bridge C, and nearly 3 feet narrower than those of bridge A. Some vessels drawing from 20 to 22 feet, which could pass bridges A and C at average height water, can not pass this bridge; hence, the sugar refineries using wharves located above bridge C are prevented from employing such vessels.

The best mode of altering this bridge so as to prevent this obstruction is to widen the draw-openings to a least width of 42½ feet. The cost of this alteration would probably not exceed $3,000. It would require the suspension of travel across the bridge for several days.

(*b*) The direction of the draw-pier does not conform with those of the piers of the neighboring bridges; consequently, vessels having passed at ebb-tide through the draw-opening on the Boston side (where at present the water is deepest) are in danger of colliding with the upper end of the draw-pier of the Congress Street Bridge.

The best mode of altering this bridge so as to prevent this obstruction is to reconstruct the lower part of the draw-pier so as to align it with those of the neighboring bridges. This would cost about $5,000, and can be done without stopping travel across the bridge.

(*c*) Complaints have been made that vessels are often delayed because the draws of this bridge are not promptly opened. This is due to the many trains which pass the bridge in quick succession.

Under the law of the State of Massachusetts, a railroad train is allowed fifteen minutes before and after its tabular time, and any approaching train further reasonable time for crossing a draw-bridge; hence, where many trains are run at short intervals, the draw may be continuously closed for many hours.

No alteration of the bridge can overcome this difficulty. The inconvenience might, perhaps, be somewhat lessened by a change in the State law.

If the project for deepening the Fort Point Channel to 23 feet at mean low water is carried out, as recommended in my report dated January 27, 1885, more extensive changes than those above indicated must be made in this bridge, since its piles extend only to 22 feet below mean low water. It does not, therefore, seem desirable to urge immediate action.

b. The Old Colony Railroad Bridge interferes with free navigation on account of the delay in opening its draws, due to the great number of trains passing over it. No alteration in the bridge is necessary.

---

* Omitted.

(2) CHARLES RIVER.

The seven draw-bridges situated between the river's mouth and East Cambridge (marked D, E, F, G, H, I, J, K on map*) interfere with free navigation, owing to their proximity to each other. Although the problem of re-arranging and modifying these bridges has been often and thoroughly investigated, no practical plan consistent with the necessities of the railroad and city travel has been developed.

The most serious obstructions to the navigation of the river are the railroad bridges (marked F, G, H, I, J on map*). The frequent passing of trains renders delays in opening the draws unavoidable. The inconvenience is greatest in connection with the Boston and Maine Railroad Bridge (marked G on map*) and the consolidated bridge of the Eastern and Boston and Lowell railroads (marked H, I on map*), which has two independent draw-sections. These bridges are so near together that it is necessary for the passage of a vessel of the larger class navigating the river to have the three draws open at the same time. The time-tables of the three railways not being arranged with a view to facilitate navigation, this coincidence of openings is often impossible, and long delays occur. It is almost a rule for the draws of the Eastern Railroad Bridge to be closed from four to five hours at a time in the morning, and about as many hours in the afternoon. Instances have been reported where as many as twenty-two vessels have been thus detained for many hours.

These difficulties can not be obviated by any practicable alteration of the bridges. Some improvement could be obtained by introducing steam-power for moving the draw-sections, but the benefit would be comparatively so slight that it does not appear to justify the trouble and expense.

The obstruction to navigation arising from the bridges crossing the Fort Point Channel and the Charles River, above specified, can not be removed or diminished by the construction of booms, dikes, piers, or any other structures for the guiding of vessels.

Very respectfully, your obedient servant,

CHAS. W. RAYMOND,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL GEORGE H. ELLIOT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, R. I., December 8, 1884.

GENERAL: Referring to General Orders, No. 13, Headquarters Corps of Engineers, current series, * * * respecting the interference with free and safe navigation of bridges and other structures within my district, I have to state I have visited Pawtucket (Seekonk) River, and submit the following report concerning the two bridges which cross that river just above its confluence with Providence River.

THE WASHINGTON BRIDGE.

This highway bridge, originally built in 1793, was rebuilt in 1815, with a draw, opening close to the eastern end of the bridge. By reason of this location and of the width of the draw-span, only 38 feet, and the insufficient depth of water through it, this bridge is a great obstruction to navigation, but the State legislature, at its January session of 1883, enacted a law requiring the city of Providence to remove—

---

* Omitted.

> The stone and other materials deposited in the Seekonk River under and near Washington Bridge, so called, at India Point, in said city (Providence) from said river, and cause the channel thereof under and around said bridge to be dredged and cleared of all obstructions to the flow of the tides into and out of said river, to a depth of 15 feet at low water, and reconstruct said bridge with a swing-draw in the main channel of said river, with an opening on each side of said draw not less than 80 feet wide, for the safe and convenient passage of vessels navigating said river through the same, in such manner as the harbor commissioners shall approve

The new bridge is now in process of construction, and it is expected that it will be completed and the old bridge and the obstructions at and about it will be removed by the 1st of May next.

THE RAILROAD BRIDGE.

About 250 feet below the Washington Bridge is the railroad bridge of the Boston and Providence Railroad Company. I quote from the annual report of the late General Warren for 1874 the following description of this bridge and the present arrangements for the passage of vessels through its draw:

> This bridge is 396½ feet long, divided into three spans and a draw. Commencing on the west side, there is, first, a span of 113 feet; next, one of 108½ feet; next is the draw, 154 feet, with openings of 60 feet in the clear; and last, a short span of 20¾ feet, one end of which rests on a stone pier, the only one in the bridge, the other end resting on the abutment. The superstructure is a Howe truss. * * * To facilitate the passage of vessels through this and Washington Bridge, double lines of piling have been put in between the draws of the two bridges. This piling has been extended about 300 feet above Washington Bridge, and one line has been extended about the same distance below the railroad bridge. The space between these lines of piles varies from 38 to 60 feet. Vessels going up the river enter this passage at an angle with the current, and pass the railroad bridge at an angle of 20 degrees with the axis of the piers. When they reach Washington Bridge, a turn must be made to the left of about 45 degrees. This turn has to be in the draw of the bridge, where the passage is only 38 feet wide. These vessels pass up the river at high water, when there is but little current. They can not tow through safely because of the sharp turn above alluded to, but have to warp through and make up the tow above. In descending they generally leave Pawtucket after the tide commences to run out, and reach these bridges when the current is very swift, often as much as 5 miles per hour. To break up a tow in a current like this, so as to enable the vessels to warp through, would be attended with great danger of being carried down onto the bridge to the west of the draw. Their only course is to be taken through by the tug, and this must be done at a speed greater than the current, in order to keep steerage-way. In making this passage they are very frequently damaged by coming in contact with the piling. Once in the passage there is no escape, except with the current at the lower end.

The *width* of the draw-openings in the railroad bridge was directed by the act of the legislature which authorized the construction of the bridge. Their *location* was doubtless selected to suit, as far as possible, the location of the draw in the old Washington Bridge.

The combined obstruction furnished by the Washington Bridge and the railroad bridge is a very serious one, as will be seen from the plat* herewith.

It has for many years been the cause for much complaint by the citizens of the enterprising town of Pawtucket, which is situated about 4 miles above the bridges, and is extensively interested in manufactures which depend on water transportation, and it has delayed for years appropriations by the General Government for the improvement of Pawtucket River. Neither the location nor the plans of these bridges received the sanction of Congress, and I may also remark that this is the case also with the new bridge which is now building above the present site of the Washington Bridge. The location and the width of the draw-openings of the new bridge seem to be judiciously arranged, and when it is completed it is barely possible that the railroad company can, by dredging below its bridge, so as to carry the channel further to the eastward, and by a new arrangement of the guides to its western draw-opening, facilitate sufficiently for the present the passage of vessels, but for the following reasons I do not deem this probable.

---

* Plat omitted.

The new highway bridge and the railroad bridge are only about 500 feet apart. There is only one available draw-opening in the railroad bridge. It is but 60 feet wide, and 15 feet of this width is taken up by the oblique guides through the draw. When the new highway bridge is completed and the guides at the railroad-bridge draw are newly arranged to suit the new location of the draw in the highway bridge, the available width of the draw-opening in the railroad bridge can be somewhat increased, but in any case it can not be made much more than 50 feet. The draw-openings in the new highway bridge are neither of them opposite the single available draw-opening in the railroad bridge. The *western* side of this opening is about 20 feet to the *eastward* of the western side of the *eastern* draw-opening in the new highway bridge, and just below the railroad bridge the river makes a sharp turn to the westward.

To sum up: There is but one available draw-opening in the railroad bridge. It is too narrow, and there should be two. It is so far to the eastward that the passage of vessels through the bridges will be tortuous and, when the tide is running, dangerous. It will doubtless be found necessary to remove the draw-openings in this bridge to the westward, so that they will be opposite or nearly opposite the draw-openings in the new highway bridge, and to increase the width of the former to 80 feet, which is the width of the latter; but action by the General Government may be delayed in this case until the new highway bridge is finished and we can see the result of the change in location of its draw. This is in consideration of the possibility before mentioned, and of the fact that the legislature of Rhode Island, at its last session, enacted the following law looking to the modification of the draw of the railroad bridge by State direction, if it be found necessary after investigation by the committee provided for in the act:

RESOLUTION appointing a joint special committee on the obstructions in the Seekonk River below the site of the Providence Washington Bridge. } No. 4, passed May 29, 1884.

Resolved, That a joint special committee consisting of Messrs. William W. Blodgett, of Pawtucket, William A. Harris, of Providence, and Ellery H. Wilson, of East Providence, on the part of the house of representatives, and Messrs. Henry B. Metcalf, of Pawtucket, John P. Gregory, of Lincoln, and Edward C. Dubois, of East Providence, on the part of the senate, be appointed to inquire into and report what obstructions to the navigation of the Seekonk River exist below the site of the present Providence Washington Bridge, and what, if anything, ought to be done to effect the removal of such obstructions; that said committee be authorized to sit during the recess, and be directed to report in print, by bill or otherwise, to the general assembly at the January session, A. D. 1885.

With this report I submit copies of letters respecting the obstruction to navigation caused by the railroad bridge, which I have received from citizens of Pawtucket, and also a plat,* for which I am indebted to the courtesy of Capt. J. P. Cotton, one of the commissioners and the engineer of the new bridge, showing the present location of the Washington Highway Bridge, the new location of this bridge, and the location of the railroad bridge.

---

* Omitted.

Very respectfully, your obedient servant,

GEORGE H. ELLIOT,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

LETTER OF THE PRESIDENT OF THE TOWN COUNCIL OF PAWTUCKET, RHODE ISLAND.

PAWTUCKET, R. I., *August* 16, 1884.

DEAR SIR: Yours of the 2d instant was duly received, but have delayed answering, as Mr. George E. Newell, who has been appointed by the governor as one of the commissioners to construct a new bridge in place of the Washington Bridge, has been out of the State.

There are no causeways or structures now erected or in process of erection that will interfere with the free and safe navigation of the Pawtucket River, except the Washington Bridge and railroad bridge near its mouth. A new bridge is in process of erection in place of the Washington Bridge, with good and sufficient draw-openings. The railroad Bridge, with insufficient draw-openings, is a serious obstruction to navigation, and could be remedied by making a wider draw nearer the center of the river.

It is an undisputed fact the railroad bridge is the only structure upon the river that is an obstruction to our river.

Inclosed please find letters from some of our prominent citizens, giving their views. Should you wish further information, I shall be pleased to inform you to the best of my ability.

Very respectfully,

E. A. GROUT,
President Town Council.

GEORGE H. ELLIOT, Esq.,
Lieut. Col. of Engineers.

LETTER OF MR. GEORGE E. NEWELL.

PAWTUCKET, R. I., *August* 16, 1884.

DEAR SIR: In reply to your communication in relation to the railroad bridge over Pawtucket River, I find it is an obstruction to the free navigation of the river. The draw is narrow, and it purports to be 60 feet; it is practically but 45 feet, or nearly that. It is a serious obstruction to the passage of large vessels and barges. It should be widened and located differently. This draw is in the bend of the river, which makes it more difficult for vessels to get through. In my opinion, it should be placed farther west, and have two openings of not less than 80 feet each in the clear.

Respectfully, yours,

GEO. E. NEWELL.

Mr. E. A. GROUT,
President of the Town Council, Town of Pawtucket, R. I.

LETTER OF MR. L. D. HORTON.

PAWTUCKET, R. I., *August* 15, 1884.

SIR: Your inquiry in regard to the obstruction to navigation of the Pawtucket River is at hand.

In answer would say that while the proposed removal of Washington Bridge ameliorates the condition of navigation, a very serious and important obstruction will remain in the railroad bridge just below, on account of its position, causing a crooked passage-way, its width of draw rendering it impossible for craft to pass and repass, being obliged to turn while passing.

The only remedy is in constructing a draw of suitable width, 80 feet at least, in lieu of the present narrow one of 45 feet, farther to the westward, thereby straightening the passage-way for vessels.

Yours, with respect,

L. D. HORTON.

E. A. GROUT,
President of Town Council, Pawtucket, R. I.

REPORT OF LIEUTENANT COLONEL WALTER M'FARLAND, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New Haven, Conn., January 14, 1885.

GENERAL: Under section 2 of the act of Congress relating to rivers and harbors, approved July 5, 1884, I have the honor to report as follows

* * * * * * *

upon bridges and other works which interfere with free and safe navigation, all in the engineer district of which I have charge, extending from the headwaters of the Hudson River to the eastern end of Long Island Sound.

Very respectfully, your obedient servant,

WALTER MCFARLAND,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT UPON BRIDGES, CAUSEWAYS, OR STRUCTURES WHICH INTERFERE WITH FREE AND SAFE NAVIGATION OCCURRING OR EXISTING IN THE ENGINEER DISTRICT EXTENDING FROM THE HEADWATERS OF THE HUDSON RIVER TO THE EASTERN END OF LONG ISLAND SOUND.

ENGINEER OFFICE, UNITED STATES ARMY,
New Haven, Conn., December 31, 1884.

The only instances of this kind which have come under my notice in this district are those which occur in streams flowing into Long Island Sound.

Complaint has been made to me of the following bridges, namely: Those belonging to the New York, New Haven and Hartford Railroad Company, (1) at Cos Cob, Conn.; (2) Bridgeport, Conn.; (3) the Housatonic River, Connecticut; (4) New Haven, on the Quinnipiac River, Connecticut; (5) Middletown, on the Connecticut River, Connecticut; (6) the city bridges at Bridgeport; (7, 8) the city and the Tomlinson Bridges, at New Haven, Conn.

The complaints against the railroad bridges crossing the Housatonic and Connecticut rivers (3 and 5) are that the under-water part of the piers at the draws projects so far into the stream, and into what appears to be and ought to be a clear-way, that the safety of vessels passing through the draw is endangered, and one or two vessels have already been seriously damaged by striking these hidden projections.

The remedy for this is the breaking off of these projecting parts and the placing of fender-piles to prevent passing vessels from coming in contact with the piers. Any projection of this sort, or any batter to the faces of the draw-piers, causes a sensible reduction in the width of the draw-span, making it less than it appears and is presumed to be, and probably less than the law under which it was constructed requires it to be.

The complaints against the railroad bridge and the city bridge at New Haven (4 and 7), crossing the Quinnipiac River, are that they are both without draws, and so prevent 6 miles of the Quinnipiac River which are navigable, and were formerly used, from being any longer used. The city bridge formerly existing there had a draw in it. The new one has not, nor has the railroad bridge, which crosses near it. It is evident that by these constructions the right of the property-owners above these bridges to the free navigation of this part of the Quinnipiac River has been violated. The remedy is to require the city of New Haven and the railroad company to put draws in these bridges, without which they are obstructions to the navigable waters of the United States, according to the decisions of the Supreme Court of the United States.

The complaint against the Tomlinson Bridge (8), which crosses the mouth of the Quinnipiac, is that its draw is narrow and dangerous from the strong current through it, produced by the contraction of the natural water-way from 1,400 to 310 feet, caused by the construction of a solid causeway 920 feet long, and five clumsy piers, taking up 170 feet more. The effect of all this is exceedingly bad, as it prevents the free inflow and outflow of the tides, and nearly destroys the usefulness of the Quinnipiac River above the bridge as a tidal basin. The obstruction to the passage of the water is so great that the bottom between the piers has been scoured to a depth of 18 feet, where the normal depth should be but 9 feet, and I have seen the water on one side of the causeway standing a foot higher than it was on the other side at the same time.

This bridge is owned by a bridge company, but is, I understand, now in the possession of or controlled by the New York, New Haven and Hartford Railroad. On account of the difficulty of the passage of the draw, boats are every now and then capsized there, in consequence of being thrown against the piers by the violent current. The bridge is in a dilapidated condition, and ought to be removed and replaced by a more modern construction, which would permit the free passage of the tides, and which should be provided with a sufficient draw. It now constitutes an obstruction to a navigable channel of the United States, as defined in the decisions of the Supreme Court and in the act of Congress under which this report is being made. Its piers are three times as thick as they should be.

The complaints against the railroad bridges at Cos Cob (1) and Bridgeport (2) are that the draws are managed in such a way that they practically close the streams which they cross to navigation. I inclose a copy of the complaint received concerning the Bridgeport Bridge, from which it appears that under the railroad regulations this bridge is kept closed about twelve hours out of the twenty-four, and about ten of these hours are between daylight and dark. The same complaint is made about the Cos Cob Bridge.

Congress has repeatedly by law authorized the construction of draw-bridges over the navigable waters of the United States, so that a draw-bridge is not to be regarded in itself as an obstruction to navigation in a legal sense; but it is evident that although its construction may be authorized by law, yet it may be so managed after construction as to impede navigation unnecessarily, and thus become such an obstruction to the navigable water which it crosses as to demand its abatement. The traffic over the railroad to which this bridge belongs is very large, from sixty to seventy passenger trains passing it every twenty-four hours, while the number of vessels which have to pass through the draw daily is quite small. It is plain that the larger interest can not give way to the lesser one, and the only point that needs to be determined here, then, is whether the larger interest shows due respect to the lesser and does what it can to avoid obstructing it, or whether, secure in its power, this wealthy railroad corporation disregards its obligations towards its weaker competitor, a part of whose rights it has already taken away under the protection of the law and obstructs its operations.

Most of those engaged in navigation at Cos Cob and Bridgeport, whose vessels must pass these draws, are men of humble means, who must make their living out of these vessels, and who can not defend themselves against a rich corporation like this if it chooses to oppress them, which it may readily do by omitting to take the means necessary for facilitating the passage of their vessels through the draw. The accompanying copy of the complaint from Bridgeport shows what difficulties are encountered by tows attempting to pass the draws there. The complaint makes no mention, however, of another source of trouble that is felt particularly at Cos Cob. Here there is so little water that unless a vessel goes through at a high tide she can not go at all, and if when high tide occurs the bridge is closed, the vessel must often wait for the next high tide, and if this occurs after dark, she must wait again for the next one occurring in daylight or take the chance of grounding in the dark, and so it may be delayed twenty-four hours, and if the cargo consists of garden produce, as is often the case, intended for the New York market, it is often rendered unsalable by the delay, and the owner and carrier suffer the loss. This is, of course, no reason why the operation of a great line of travel should be obstructed or interfered with, but it is a very good reason why the corporation that manages it in their own interest should pay for the damage which the pursuit of their own interests causes to those who originally had a right to the free and unobstructed use of these waters.

The remedy for this difficulty is this: The draws should be of the most approved form, to be quickly opened and closed by steam-power. The regulations requiring them to be closed ten minutes before a train is due should be rescinded, and such signals should be established as would indicate to an approaching train, day or night, whether the draw is open or not, as is done on other railroads.

The vessels should have the prior right of passage, as trains would seldom be delayed by them, and when delayed the time lost would commonly be made up, while with the incessant passage of trains the vessels must be delayed hours, and may be delayed a day, time which they can not make up, and which must prove a serious loss to men who are not able commonly to bear it.

In being permitted to construct bridges across navigable streams, railroad companies acquire valuable rights, which materially increase their revenues, while shippers suffer a corresponding loss. It is only fair that this loss should be borne by those who reap the benefit, which might be done by requiring the company to pay the owners of vessels at established rates for all delays caused by the non-opening of their draws when required, or by requiring them to keep tugs at hand to help these vessels through the draws. The real question here is whether the law will compel a rich and powerful corporation to deal fairly and justly with those who have already been by law compelled to surrender to it a part of their rights, ostensibly for the public good but practically for the good of the corporation only.

The complaint against the city bridges at Bridgeport (6) is the same as that against the railroad bridge there. The only difference here is that the city corporation takes the place of the railroad corporation in the preceding case. It may be left to the city of Bridgeport to decide what is best for their city interests; but if for the good of their community they find it expedient to obstruct the navigable waters of the United States, they should pay for the damage that they do to those who are entitled to the unobstructed use of those waters, and they should, moreover, provide every facility for passing vessels through the draws with as little delay as possible.

I submit herewith copies of the written complaints against the Bridgeport and New Haven city and railroad bridges, and the railroad bridge across the Connecticut at Middletown.

Respectfully submitted.

WALTER MCFARLAND,
Lieut. Col. of Engineers.

COMPLAINT AGAINST THE BRIDGE AT BRIDGEPORT, CONNECTICUT.

BRIDGEPORT, CONN., *August* 21, 1884.

SIR: In response to your circular asking for information concerning bridges, causeways, or structures that are an obstruction to navigation, we wish to write you in behalf of the Messrs. Beardsley, who do an extensive towing business in this vicinity.

On May 17, 1884, we wrote the honorable Secretary of War upon this same subject. Whether this letter was referred to you or not we do not know, but take the liberty of giving several extracts from said letter, as the troubles and dangers complained of therein still exist and flourish in all their original vigor. "The common council of Bridgeport has passed an ordinance relative to draw-bridges * * * by which all the four draws are closed from 6.40 to 7 a. m., from 12 to 12.20 p. m., from 12.40 to 1 p. m., and 6 to 6.20 p. m. Under the city's orders, the draws are closed one hour and twenty minutes during the busiest portions of the day, when boats wish to be placed at their docks to be unloaded. Between 12 and 1 o'clock the draws can be opened for the benefit of navigation only twenty minutes, and, inasmuch as a tow after passing through the first bridge could not reach the last before the twenty minutes of grace has expired, it is an actual obstruction for the whole hour.

"The New York and New Haven Railroad has also given to the draw-tender the following order, to wit, being number 49 of special instructions: 'No draw shall be opened within ten minutes of the time that a train is due, nor when a train is in sight or within hearing.' This draw-bridge is used both by the New York and New Haven Railroad and the Naugatuck Railroad, and about seventy trains cross it daily, so that the draw is closed by the railroad company eleven hours and forty minutes during the twenty-four hours of the day, which, with the time it is kept closed by the city, makes thirteen hours' time during which no tow nor boat can pass through the bridge. This is computed for the whole twenty-four hours, and most of the eleven hours left come in the night time, when the trains are much less frequent and when no towing is required.

"Between 6 o'clock in the morning and 6 in the afternoon fully fifty trains cross the bridge at short intervals, keeping the draw closed eight hours and twenty minutes, and, adding the time it is kept closed by the city, we find that it is closed nearly *ten hours out of the twelve.* Of course, if a train is late, the draw is kept closed until it is past.

"The two hours left during which the draws may be opened is scattered through the twelve hours in such small portions that it is almost impossible to make a continuous trip. If there were but one draw, there would be but little trouble, as a tug with a tow could time its start so as to get through without having to wait; but passing through one bridge, and having nearly reached the next, it may have become within ten minutes of the time when a train is due or the city's order may interpose, and the draw, after having been opened, is quickly shut and passage is barred. Then the trouble begins. The tug, of course, can stop and control itself, but a heavily-loaded schooner or barge acquires a momentum which makes it exceedingly difficult to stop it when the draw is suddenly closed against its passage. It is only by the most strenuous exertions that the tugs prevent their tows from either crushing into themselves or dashing into the bridges, and hardly a day passes without a narrow escape from a serious and perhaps fatal accident, the bowsprits of sloops and schooners having several times nearly pierced the pilot-houses of the tugs, which have been unable either to get out of the way themselves or to stop their tows. But if they succeed in stopping the craft in tow without loss of life, limb, or property, they have to wait from ten minutes to half an hour for the draw to reopen. In the mean time they are drifting about in the narrow channel or get aground on the shallow mud flats, and by the time they get straightened out and get under headway again the chances are that either the bridge they have been trying to get through, or at the best the next one, will be closed; so that in this way, independently of the danger incurred, it requires two or three hours to do what could otherwise be done in half an hour."

For the past week the draw of the bridge over the Housatonic River has been kept closed, to the great detriment of those engaged in the towing business, as well as consignees and ship-owners.

The bridge contractors keep the draw closed not because it can not be opened, but because it is a little more convenient for them in the prosecution of their work.

There is also a very dangerous obstruction to navigation at the east pier of stonework supporting the draw to the center bridge. Messrs. Beardsley had heretofore, in going through the draw, injured and nearly sunk one boat loaded with coal, and roughly scraped several others, upon an unknown object.

They then employed Captain Scott, the diver, to examine the pier and see what caused the trouble. He went down in his diving armor, and found that the lower part of one of the corners projected out into the channel 2 *or* 3 *feet beyond the upper portion*. Evidently the brilliant genius who planned the work found that if the pier should be carried up as started it would encroach too far into the channel, so he merely dropped back with the upper part and left this sharp triangular projection to tear open the sides of any boats coming in contact with it. We understand that this corner is visible only at an unusually low tide, and, as no towing can be done then, its presence there was not suspected till the diver made his report. Any one going through would be justified in supposing he could run close to the pier, whereas he really can not go within 3 feet of it without wrecking or injuring his boat. The city authorities have been notified of this obstruction, and have been requested to remove it, but although the diver says it can be easily and cheaply blown off, nothing has been done to remove it.

This projecting corner, and especially the trouble and delay experienced in getting through the draws, are a source of great vexation to both those who do the towing and consignees, who are delayed in getting their boats to their docks. Any relief that can be granted by the Government authorities will be duly appreciated.

Very respectfully, yours,

HOLLISTER & KELSEY,
Attorneys.

Col. WALTER MCFARLAND,
United States Engineer.

COMPLAINT AGAINST THE RAILROAD AND CITY BRIDGES AT NEW HAVEN, AND OTHER BRIDGES CROSSING THE QUINNIPIAC RIVER, CONNECTICUT.

NEW HAVEN, CONN., *August* 20, 1884.

DEAR SIR: Having noticed in the New Haven Evening Register of a recent date that you desire information, among other instances, as to whether any bridges, etc., now erected or in process of erection do or will interfere with free and safe navigation, and, if so, a report of the best mode of altering such bridges so as to prevent such obstructions, we desire to call your attention to the bridge crossing the Quinnipiac River at Grand street; to the New London Railroad bridge, located a few rods north of it, and to other bridges on said river, a mile or so still further north. Those structures form a total obstruction to navigation north of Grand street for sailing-vessels and steamers, and it is our opinion that they, or at least the first two mentioned, should be provided with suitable draws without delay. Quinnipiac is a navigable river for 6 miles or more north of Grand street. The Grand Street Bridge was formerly a draw-bridge, and was used as such for many years, about half the vessels coming into the river passing through the draw up to the time when it was closed. It was an unwieldy affair, and was closed by the town of New Haven about sixty years since, when it was understood that a good draw would be put in soon. Ever since that time the town has persistently refused to construct a draw, although often requested to do so.

In 1851, when the New London Railroad Company were about to build their bridge, their president received written notice that steps were about to be taken for a draw in the Grand Street Bridge, and that the people residing north of that point would expect and insist upon a draw in the railroad bridge; yet it was built without a draw, and up to this date the public have been deprived of the use of this arm of the sea, in defiance of the laws of the United States.

We respectfully request you, as a representative of the General Government, to give this matter a personal examination at your convenience, and make such report thereof as in your judgment may seem proper.

Should you desire any further information, a line addressed to J. H. Goodsell, 332 North Front street, New Haven, Conn., will receive prompt attention. Hoping the action you may be pleased to take will have a tendency towards the reopening of this public highway, we subscribe ourselves,

Very respectfully, yours,

James H. Goodsell.
S. Chipman & Co.
J. E. Bishop & Co.

Col. Walter McFarland,
United States Engineer.

COMPLAINT AGAINST THE BRIDGE ACROSS THE CONNECTICUT RIVER AT MIDDLETOWN, CONNECTICUT.

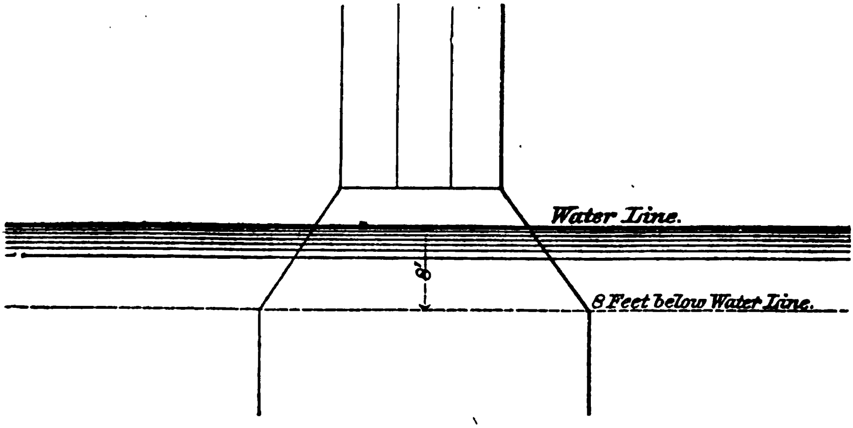
[Hartford and New York Transportation Company.]

E. H. Williams, President.
C. C. Goodrich, Agent.

Hartford, Conn., *August* 13, 1884.

Dear Sir: In accordance with your published card, I desire to have your engineers view the bridge-pier of the air-line bridge at Middletown, on Connecticut River. The unprotected abutments *below* the *line* of *low water* are such as to crush in the hull of a loaded vessel or barge before her guard-streaks can reach within 2 to 7 feet of the guard piling or pier itself. These points of contact are from 6 to 8 feet under water at low water. The schooner Rebecca, drawing 8½ feet, had whole bilge forward crushed, and sunk soon after, and is now on the ways at Gildersleeve's ship-yard, at Portland, Conn., with over $1,000 damage bill. This schooner's rail was 3 feet clear of the pier or piling when she struck. The barge Grace Hills, loaded, was similarly sunk six years ago, with like bill.

The railroads claim that their draw-opening is the number of feet required by law, hence they are not obliged to protect these points, and navigation must look out and keep far enough away from the piers so as not to hit these sunken projections. I try to draw for you the shape of this dangerous work.



All the piers are more or less like this, and at none of them can you (with a loaded craft) get near enough to reach pier or piling abreast the piers without striking the rock foundation, while the vessel would apparently be still from 2 to 6 feet away from *possible harm*.

If you will examine here and at Lyme, and cause to be properly protected, you will earn the gratitude and good will of every vessel-owner on this river.

Yours, truly,

C. C. GOODRICH,
General Agent.

Col. WALTER MCFARLAND,
United States Engineer.

REPORT OF MR. WM. F. SMITH, UNITED STATES AGENT.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., January 19, 1885.

GENERAL: I have the honor to make the following report, as called for by section 2 of the river and harbor act approved July 5, 1884:

1. In the harbor of Wilmington are the remains of two wharves in front of the light-house lot, and under the control of the Light-House Board. These wharves are built on piles, and though not within the present channel, are yet an obstacle to the free passage of the flood-tides, and should be removed. I find that their removal had been determined upon by my predecessor in charge of this harbor, but as I have not been able to find any authority from the Light-House Board for their removal, it was not included in the project for the improvement of this harbor. The cost of removing them would be about $500.

In the same harbor and on the other side of the Christiana River, about half a mile higher up, is a detached sunken pier, about 20 feet square, and below high-water mark. Like the light-house piers, this is not in the main channel, but is near enough to be dangerous at high water, and is an obstruction to the free passage of the tides, and should be removed. It was placed by private enterprise. The cost would be about $300. I inclose herewith a letter referring to this subject, received from the port-wardens of the harbor of Wilmington. Tracings* of both obstructions are also inclosed.

The draw-bridge situated at the foot of Third street is worked by hand, and so slowly as to impede navigation. The city should be compelled to put in machinery to work the draw by steam or other mechanical force.

2. On the Saint Jones River are two draw-bridges for county roads. I have been waiting till work should be commenced on the river to have accurate surveys made for a detailed report. I can state now that the lower bridge at Florence has machinery for working by hand, but no employé to do the work.

The upper bridge at Lebanon has its turning-gear out of order, and has to be worked by crews of vessels when desiring to pass. In addition to this, a false abutment was put in, to compensate for a draw too short for the original plan, and the water-way on the site of the main opening is thus narrowed, to the prejudice of the free passage of the current.

The survey will be made of both bridges as soon as the work on the river begins, when a more detailed report will be made on this subject.

The best plan of remedying these evils will be to have good turning-machinery put in both bridges, and a man employed to work it when necessary.

---

*Tracings omitted.

The false abutment of the bridge at Lebanon should be removed and the draw lengthened to reach to the abutment originally intended for it.

It should be the duty of the State of Delaware to compel the making of these improvements.

I am not at present aware of any other structures erected or in process of erection which "do or will interfere with the free and safe navigation" of any of the navigable waters in this district.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

To the CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE BOARD OF PORT-WARDENS OF THE HARBOR OF WILMINGTON, DELAWARE.

[Board of port-wardens, city of Wilmington, Del.]

NOVEMBER 28, 1884.

DEAR SIR: I was directed by the board of port-wardens, at a meeting held November 26, 1884, to communicate with you stating that the sunken pier in the Christiana River, in the line passing through harbor line stones 5 and C 7, is regarded by the board as a very dangerous obstruction to navigation, and that it will be very gratifying to the board if it please you to incorporate in your report to the Secretary of War such mention of this matter as may result in the removal of the pier by the United States Government.

Yours, etc.,

FREDERIC H. ROBINSON,
Secretary.

General WM. F. SMITH.

REPORTS OF MAJOR PETER C. HAINS, CORPS OF ENGINEERS.

(1) LONG BRIDGE ACROSS POTOMAC RIVER.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., September 10, 1884.

SIR: In compliance with General Order, No. 13, Headquarters Corps of Engineers, July 23, 1884, I have to report, for the information of the Secretary of War, that the structure known as "Long Bridge," spanning the Potomac River from Washington, D. C., to Alexander's Island, Virginia, was first built by the Washington Bridge Company, under an act of incorporation provided by act of Congress approved February 5, 1808, entitled "An act authorizing the erection of a bridge on the Potomac River within the District of Columbia."

In 1834 the Government of the United States purchased the rights of the Washington Bridge Company and the remains of the original structure, which had been partly destroyed in 1831 by a freshet. It was afterwards rebuilt by the Government and maintained by it until June 21, 1870, when by act of Congress the Baltimore and Potomac Railroad Company was authorized to take possession under certain conditions.

It has remained in the custody of said railroad company since that time, and is used and occupied by it as a railway bridge, and by the public as a wagon and foot bridge.

It interferes now with the free and safe navigation of the Potomac River, and will do so in a greater degree when the improvements now in progress on the river front approach more nearly completion. The draw of this bridge is only 70 feet wide, and, consequently, in times of freshets or high winds, does not afford a free and safe opening for large vessels. Besides, it is never opened at night at all, so that the bridge constitutes a complete barrier to all navigation through it after dark. The bridge, however, will become a serious obstruction as the work of improving the river front advances. Congress has already appropriated $900,000 for the improvement of the Potomac River in the vicinity of Washington, having reference to the improvement of navigation, the establishment of harbor-lines, and the raising of the river flats. A part of this money has already been spent, and the work is now well under way. The necessity of rebuilding Long Bridge is referred to by the Board of Engineers in its report of February 18, 1882. The report includes among its recommendations that—

> The Long Bridge shall be rebuilt at an early period, during the progress of the improvements, with wide spans upon piers offering the least possible obstruction to the flow of water.

Other engineers have at various times called attention to the necessity of a new bridge. The location of the present bridge is faulty, its construction more so. Above the bridge the channel of the river curves well over to the Virginia shore, so that at the site of the bridge the channel current, in the ordinary stages of the river, sets towards the Washington side, making, with the axis of the bridge, on obtuse angle. The piers are set parallel, or nearly so, with the current in such stages. In times of freshets, however, the direction of the current is more direct; the water takes a shorter cut across the shoals to reach its proper level. The piers of the bridge being located to best suit the low stage of the river, they stand obliquely to the current in times of freshet, making the obstruction greatest when it should be least. The bridge thus acts as a partial dam in times of freshets, checking the flow of water above and causing the deposition of the material that is rolled along the bottom or held in suspension.

The spans of the bridge are too narrow, requiring a greater number of piers than would otherwise be needed, consequently the flow of water is proportionately obstructed. While the number of piers is unnecessarily great, and their direction with reference to the freshet current objectionable, a still more formidable objection exists in the construction of the piers themselves. They are built of stone on a pile and grillage foundation, and to the ordinary observer would appear unobjectionable except in respect to number, height, and location with reference to the freshet current. The pile and grillage, however, reaches to about the level of low water, and is not ordinarily seen; but, in order to make the foundation secure, a large quantity of riprap stone has been deposited around each pier, so that while each pier seems to be narrow, it pratically spreads out like a cone beneath the surface of the water.

The bottom chord of each span is too low, being only 10.7 feet above low water. The adjacent flats are to be filled to a height of 3 feet above the freshet slope of 1877, which will make them at the site of the bridge about 12 feet above low water. The bottom chord of the bridge is, therefore, only a little more than 1½ feet above the level of the freshet slope of 1877, and nearly 1½ feet below the proposed grades of the flats when they are reclaimed from overflow.

The effects of logs, trees, etc., swept down the river and against the bridge in such a freshet can readily be imagined. It was practically destroyed in 1831 by such a freshet.

The improvements now in progress contemplate the closing of the Washington Channel at the site of Long Bridge; hence, all the water that now finds its way down the river by that route will be forced into the Virginia Channel. The capacity of the latter must, therefore, be increased. This is now being done above the bridge, and it will be done below it, by dredging. To secure the required area of cross section through the bridge would require dredging to be done between the piers, which, it is believed, is not practicable to the extent required without endangering the structure.

The best and only satisfactory way of correcting the defects of this bridge is to build a new one several feet higher, on fewer piers, with wider spans. The piers should be set as nearly as practicable in the axis of the freshet current, and should rest on the rock or hard-pan, which it is believed will be found to underlie the softer strata of mud. In any case, the body of each pier should extend to a depth below the surface of the water equal to the ruling depth of water above and below the bridge.

No riprap protection should be allowed around the piers to reach a level above that of the general bottom of the river channel in the neighborhood of the bridge.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

(2) POTOMAC AQUEDUCT.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., November 5, 1884.

SIR: In accordance with General Orders No. 13, current series, Headquarters Corps of Engineers, United States Army, I have to report that the bridge known as the "Aqueduct," that spans the Potomac River between Georgetown, D. C., and the Virginia shore, is an obstacle to the free and safe navigation of the Potomac River.

The bridge is an acqueduct for the Washington and Alexandria Canal, which is here carried across the Potomac River.

The piers of the bridge are built of stone, the superstructure being of wood. There is ample width between the piers for the largest vessels that come to Georgetown to pass, and the depth of water is over 20 feet at low tide.

At mean high tide there is only a clear space of 25 feet between the timber supports of the lower chords of the truss and the surface of the water. As a consequence, none but the smallest of steam-boats can pass under it, and practically it renders navigation above the bridge impracticable for anything but small tugs and flat-boats.

Paragraph 2550, Revised Statutes, provides that the collection district of Georgetown shall extend to the head of the navigable waters of the Potomac River, which is near Little Falls. Between the latter place and the Aqueduct Bridge, a distance of more than 3 miles, there exists a deep, navigable channel, obstructed only at two places by shoals, which have over them a depth of 16 and 19 feet, respectively, at mean high tide. On the Georgetown side of the river there is over 19 feet at high tide for a distance of 3,000 feet above the bridge.

In a commercial point of view, that part of the river would be of great value if the way to it was not barred by this bridge.

It is an obstruction in another respect. The piers, abutments, and causeway reduce the width of the river from about 1,600 feet, its natural width between the lines of high water, to about 950 feet. This reduction causes an abnormal rise in the surface of the water in times of freshets.

The bridge can best be altered so as not to interfere with the free and safe navigation of the river by discontinuing its use as an aqueduct, and providing a draw through which vessels can pass. This would necessitate the entire rebuilding of the superstructure, and the modification of one of the abutment piers to serve as a draw-pier.

Other interests may be involved in such a change, but a discussion of them is beyond the province of this report. The bridge interferes with the free and safe navigation of what would doubtless become a very important part of the river were it not there, and the only satisfactory way of removing this interference is to dispense with the aqueduct portion and rebuild the superstructure as a highway bridge, with a suitable draw for the accommodation of vessels of the largest class that visit Georgetown.

Very respectfully, your obedient servant,

PETER C. HAINS,
Major of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., October 31, 1884.

GENERAL: In accordance with General Order No. 12, Headquarters Corps of Engineers, U. S. Army, current series, relative to sections 2 and 8 of the act of July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, I have the honor to submit the following final report on all the matters known to me in this district covered by the foregoing:

The following bridges are considered obstructions to the free navigation of the waters that they cross, for the reasons specified below, viz: The Norfolk and Western Railroad bridges over the Eastern and Southern branches of the Elizabeth River (shown on the accompanying map*) and the wagon bridge over Town Creek, North Carolina, 3½ miles above its mouth. Each will now be referred to in detail.

(1) *The Norfolk and Western Railroad Bridge over the Eastern branch of the Elizabeth River.*—The present draw-opening is at the extreme northern end of the bridge at the right bank. It is 40 feet in the clear, and has a depth through it of 13 feet at mean low water. The approaches to this draw are as follows: The upper approach is very crooked and shallow from the main channel to the draw-opening. On a line perpendicular to the draw-opening, and about 300 feet above it, is a shoal with but 1½ feet of water on it at mean low tide. The lower approach has been lately dredged by the United States, and, so far as depth is concerned, is satisfactory. The draw-opening should be at least 50 feet wide, and placed near the middle of the stream, where the deep channel is, between the piers marked A and B, with suitable guide-piles above and below for safety of navigation through it.

(2) *The Norfolk and Western Railroad Bridge over the Southern branch of the Elizabeth River.*—The river at this point has been contracted by

---

* Map omitted.

earthen causeways, terminating in masonry bridge abutments on either side, that on the east side being 88 feet long and that on the west side 256 feet in length. The present draw-opening is at the extreme eastern end of the bridge, is 40 feet, in the clear, and has a depth through it of 8 feet at mean low water. The approaches to this draw are on a curve, and hard for vessels, particularly those with tows, to make, especially when the wind blows from certain quarters.

I quote as follows, relative to this bridge, from report dated January 30, 1872, of the late Capt. C. B. Phillips, Corps of Engineers, found in report of the Chief of Engineers, 1872, page 719:

* * * * * * *

> Below the lock of the Dismal Swamp Canal no difficulty is experienced in the navigation of the Elizabeth River. A deep and unobstructed channel exists up to this point and, in fact, to a point about 2 miles farther up the river.

The above remark should be qualified by stating that the Norfolk and Petersburgh Railroad Bridge, which crosses the river about three-fourths of a mile above the Dismal Swamp Lock, causes considerable annoyance to shipping, much of which is taken up and down the river in long tows. As many as five schooners sometimes constitute a single tow.

The draw of the bridge referred to is badly located. It is nearly over to the right bank of the river, away from the deepest water, and out of the course which shipping would take were it not for the bridge. This evil, however, it appears must continue to exist, as litigation has, I understand, failed to correct the matter.

* * * * * * *

(The Norfolk and Petersburgh Railroad is now a part of the Norfolk and Western Railroad.)

The draw-opening should be at least 60 feet wide, and placed near the middle of the stream, where the deep channel is, between the piers marked C and D, with suitable guide-piles above and below, for safety of navigation through it.

(3) *Bridge over Town Creek, North Carolina.*—I quote as follows regarding this bridge, from report dated August 4, 1884, of the late Mr. W. H. James, assistant engineer:

* * * * * * *

> Town Creek, North Carolina, for the improvement of which $1,000 was appropriated by act approved July 6, 1881, and expended under my charge, for an account of which work reference is respectfully made to Appendix K 17, of the Annual Report of the Chief of Engineers for 1883, is obstructed 3½ miles above its mouth, on the west side of the Cape Fear River, 8 miles below Wilmington, by a common county-road bridge, belonging to the county of Brunswick, North Carolina. This bridge has no draw. The creek is navigable for the improved distance of 19 miles from its mouth for small steam-launches drawing not over 3½ feet of water. These boats, in passing under the bridge, have to lower their smoke-stacks, and, for want of a draw, none but very small, low boats can pass at all. I am informed that if compelled to put in a draw or abandon the bridge, the county would probably remove it and close the road.

It is manifest that there should be either a proper draw-opening in this bridge or else it should be removed.

It is believed that the southern abutment or causeway (shown on accompanying map*) to the county bridge that formerly crossed the eastern branch of the Elizabeth River interferes with the free and safe navigation of said river to the extent described below, for which reasons the structure should be removed.

---

* Map omitted.

In my communication to you of the 1st ultimo, relative to Norfolk Harbor, I stated as follows in regard to this:

* * * * * * *

It is thought that the shoaling at the mouth of Eastern Branch is very largely due to natural causes that will always exist, aided heretofore by the county bridge, a part of which has been removed, as stated, leaving the southern abutment, *which should also be removed.* There are no means of ascertaining the amount of deterioration due specifically to this bridge.

* * * * * * *

I also quoted in said communication from reports as follows:

1. Report dated January 30, 1872, of the late Capt. C. B. Phillips, Corps of Engineers (Report of the Chief of Engineers, 1872, page 722).

* * * * * * *

We find slight and rather peculiar changes in the bed of the harbor between the county bridge across the Eastern Branch and the confluence of the two branches. We find a slight tendency of the channel to deepen immediately and for some little distance below the bridge.

Further down (some 800 yards below the bridge) shoaler water, which, as far as is known, has always existed, is encountered, and continues until the influence of the Southern Branch is felt. The depth of the shoaler water referred to has changed but little since the soundings were taken by the Coast Survey. It appears to have filled in very slightly. Its worst feature seems to be that the shoal is slowly extending along to the wharves immediately below the ferry. I attribute these changes to the existence of the county bridge across the Eastern Branch. The stream is considerably contracted at this point by a long causeway, which constitutes the southern extremity of the bridge.

This accounts, in my opinion, for the slight deepening immediately below the bridge, and also for the slight additional shoaling below, the removed material being deposited as soon as the wider portion of the stream is reached.

It will be perceived that a considerable deepening has taken place immediately at the confluence of the two branches. This would seem to be but the mere result of the changes just referred to, the gradual extension of the shoaler water near the ferry seeming to contract the width of the Southern Branch channel, and causing it to make deeper water. From this point on towards the entrance of the harbor, and also in following up the course of the Southern Branch, the water in the channel seems to have pretty generally maintained its original depth.

* * * * * * *

2. Report dated February 15, 1875, of Mr. S. T. Abert, United States civil engineer (Report of the Chief of Engineers, 1875, Part II, pages 146–147).

* * * * * * *

The bar which occupies the main channel is partly due to the county bridge, 820 yards above.

* * * * * * *

This bridge is owned by private parties, who, I have been informed, are willing to sell it, and the city authorities have taken the preliminary steps for its purchase and removal. In order to benefit the harbor to the fullest extent, the causeway should be removed at the same time as the bridge.

* * * * * * *

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., January 15, 1885.

SIR: In accordance with the instructions of General Orders, No. 13, Headquarters Corps of Engineers, United States Army, Washington,

D. C., 23d July, 1884, I have to submit, herewith inclosed, my final report upon the * * * bridges, etc., referred to in sections 2 and 8 of the river and harbor act of July 5, 1884.

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

FINAL REPORT UNDER SECTIONS 2 AND 8 OF THE ACT OF JULY 5, 1884, MAKING APPROPRIATION FOR THE CONSTRUCTION, REPAIR, AND PRESERVATION OF CERTAIN PUBLIC WORKS ON RIVERS AND HARBORS, AND FOR OTHER PURPOSES.

* * * * * * *

NEUSE RIVER, NORTH CAROLINA (UNDER IMPROVEMENT).

Near Kinston this river is crossed by the Atlantic and North Carolina Railroad on a draw-bridge, whose draw-span is placed upon the shallow side of the river, instead of over the main channel-way. The present improvement will probably be so far finished in 1886 as to permit of a deeper navigation above this bridge at Kinston than will then be able to pass through this draw-opening. All the steamer captains whom I have so far heard from state that they have not as yet been delayed from want of water at this draw-opening, and I do not see any reason for a change in the position of a draw before 1886. I therefore recommend that this draw may be permitted to remain in its present position for the present, but that it be moved to the channel side of the river as soon as it becomes the chief serious obstruction to a permanently increased depth of navigation between New Berne and Kinston.

Near Goldsborough this river is crossed by the Wilmington and Weldon Railroad, on a single-span bridge, without a draw. The bottom of the bridge is about 17 feet above low water. The channel is said to be partially obstructed by a pier of the former bridge. Very few steamers have so far reached this bridge, although the river is navigable for several miles above Goldsborough. I therefore recommend that this bridge be permitted, for the present, to remain in its present condition, provided that the owners will clear away the obstructing portion of the old pier beneath.

Above Goldsborough, and below Smithfield, there are six county bridges, without draws, but there has as yet been no navigation demanding draws. When needed, the draws will undoubtedly be put in by the county authorities. I therefore recommend that these bridges be permitted, for the present, to remain in their present condition, provided that their owners will insert draws therein whenever needed by the steamers.

As far as I know, these eight are the only bridges below the head of present navigation which obstruct the navigation of the Neuse River.

TRENT RIVER, NORTH CAROLINA (UNDER IMPROVEMENT).

As far as I know, there are no bridges below Trenton, the head of present navigation, that obstruct the navigation of the Trent River.

CONTENTNIA CREEK, NORTH CAROLINA (UNDER IMPROVEMENT).

Between Stantonsburg, the head of present improvement, and Snow Hill, the head of present navigation, there are three county bridges, without draws, but there has as yet been no navigation demanding draws. When needed, the draws will undoubtedly be put in by the county authorities. I therefore recommend that these bridges be permitted, for the present, to remain in their present condition, provided that their owners will insert suitable draws therein whenever needed by steamers.

Between Snow Hill, the head of present navigation, and the mouth of the river there are no bridges, as far as I know, that obstruct the navigation of the Contentnia Creek.

NEW RIVER, NORTH CAROLINA (UNDER IMPROVEMENT).

As far as I know, there are no bridges below the head of present navigation that obstruct the navigation of the New River.

CAPE FEAR RIVER, NORTH CAROLINA (UNDER IMPROVEMENT).

As far as I know, there are no bridges below Fayetteville, the present head of navigation, that obstruct navigation.

* * * * * * *

TOWN CREEK, NORTH CAROLINA (TRIBUTARY OF THE CAPE FEAR RIVER, IMPROVED IN 1882–'83).

Three miles above its mouth, this river is reported to be crossed by a county bridge, without a draw, thus obstructing an otherwise 5-foot navigation over nearly 19 miles of river. I therefore recommend that the owners of this bridge be required to insert therein a draw-span of 40 feet clear width.

One mile below the present head of navigation is a second bridge, without draw, but not regarded at present as obstructing the present navigation. I therefore recommend that it be permitted, for the present, to remain in its present condition.

Between the head of present navigation and the mouth of the river these two bridges are, as far as I know, the only ones that obstruct the navigation of Town Creek.

LILLINGTON RIVER, OR LONG CREEK, NORTH CAROLINA (TRIBUTARY OF THE CAPE FEAR RIVER, IMPROVED IN 1882–'83).

As far as I know, there are no bridges below the head of present navigation that obstruct the navigation of the Lillington River.

BLACK RIVER, NORTH CAROLINA (UNDER SURVEY).

As far as I know, there are no bridges below Point Caswell, the head of present useful navigation, that obstruct the navigation of the Black River.

NORTH EAST CAPE FEAR RIVER, NORTH CAROLINA (UNDER EXAMINATION.

One mile above Wilmington, this river is crossed by the Wilmington, Columbia and Augusta Railroad, on a through bridge, provided with a suitable draw-span.

The free passage of boats on the river side of the draw-pier is rendered extremely difficult by strong cross-currents, by shoals above the bridge, and by the oblique position of the pier; while the free passage on the shore side of the draw-pier is rendered difficult by the absence of suitable fenders next to the shore, and by the presence of an old submerged bridge-pier near the river bank, about 100 yards below the present bridge. This old sunken pier is said to have occupied its present hidden position for over thirty years, and is manifestly an obstruction to the free use of the railroad-draw opening. Its removal would cost, perhaps, $200, but under the circumstances I do not think the present bridge's owner should be held responsible for the old pier's non-removal. I recommend that this old sunken pier be removed at the expense of the United States, and that the owners of the railroad bridge be required to provide suitable fenders for 100 feet above and below the bridge, on the shore side of the draw-opening.

Eighteen miles above Wilmington, this river is crossed by the Wilmington and Weldon Railroad, on a pier-bridge, without a draw-span. The bottom of the bridge is only about 10 feet above high-water mark, and seriously obstructs an otherwise clear 6-foot navigation over 60 miles of river. I therefore recommend that the owners of this bridge be required to provide it with a suitable draw, of span from 40 to 60 feet width.

Higher up, the river is crossed, at Kroom's, at Deep Bottom, and at Chinquepin, by county bridges, without draws, but up to present at these places there has not been any steam navigation demanding draws. I therefore recommend that these bridges be permitted, for the present, to remain in their present condition, provided that their owners will insert suitable draws therein whenever needed by steamers.

As far as I know, these five bridges are the only ones obstructing the free navigation of the North East Cape Fear River from its mouth up to Hallsville, the head of present navigation.

WACCEMAW RIVER, SOUTH CAROLINA (UNDER IMPROVEMENT).

As far as I know, there are no bridges below Conwayboro', the present head of useful navigation, that obstruct the navigation of the Waccemaw River.

GREAT PEDEE RIVER, SOUTH CAROLINA (UNDER IMPROVEMENT).

About 125 miles above Georgetown, this river is crossed by the Wilmington, Columbia and Augusta Railroad, on a bridge provided with a draw-span of suitable width. Projecting iron-work on the piers, swift cross-currents in the river, an improperly arranged piling-fender, combine to subject passing vessels to injury. Several miles above the railroad bridge, the river is also crossed by the toll-bridge of the Society Hill Bridge Company, on a through bridge provided with a draw-span of proper width. Swift and strong cross-currents and the absence of suitable fenders combine to subject passing vessels to injury by the bridge piers. I recommend that the owners of both these bridges be required to provide strong and suitable fenders at both ends of these draw-openings, these fenders extending 100 feet above and below the bridge, and rising above ordinary high water to within about a foot of the draw-span's lower chord.

As far as I know, these two bridges are the only ones that obstruct the navigation of the Great Pedee River.

SANTEE RIVER, SOUTH CAROLINA (UNDER IMPROVEMENT).

The canal at present being cut through Mosquito Creek, to serve as the outlet of Santee River to Winyaw Bay, is crossed near Winyaw Bay by a county free bridge, without a draw. This bridge, capable of obstructing the future navigation of the canal, is to be replaced by a draw-bridge, at the expense of the United States, in accordance with the approved projects of 1881, 1882, and 1884. (See letter from office of Chief of Engineers, U. S. Army, dated 25th September, 1884.)

About 100 miles above its mouth this river is crossed by the Northeastern Railroad, on a bridge provided with a suitable draw-span; but the projecting iron-work of the bridge-piers, combined with cross-currents in the river, are apt to injure passing steamers. I recommend that the openings be provided with suitable fenders on both ends of the span, these fenders to extend about 75 feet above and about 75 feet below the bridge, and to rise above ordinary high water to within about a foot of the draw-span's bottom chord.

As far as I know, these two bridges are the only ones obstructing the navigation of the Santee River.

WATEREE RIVER, SOUTH CAROLINA (UNDER IMPROVEMENT).

Eight miles above its mouth, in the Santee, this river is crossed by the Camden Branch of the South Carolina Railroad, on a wooden deck bridge, without a draw-span, the bottom of the bridge being 15.3 feet above low water. The use of this bridge without a draw has been specially authorized, as far as concerns the State of South Carolina, by State acts passed in 1853 and 1858.

Thirteen miles above its mouth the river is also crossed by the Wilmington, Columbia and Augusta Railroad, on a wooden deck bridge, without a draw-span, the bottom of the bridge being about 17 feet above low water.

As far as I know, these two are the only bridges obstructing the navigation of the Wateree River.

The present improvement will probably be finished next year sufficiently to allow of a tolerably clear 4-foot navigation to steamers of 52 feet width over the whole river from its mouth up to Camden. The current of this river is swift and strong, especially during high-water stages. Both bridges have already proved serious obstructions to a desired navigation.

I therefore recommend that the owners of both of these bridges be required to insert suitable draw-spans in their bridges; that the spans be at least 60 feet wide in the clear; that the openings be placed with reference to the deep water and the convenience of navigation; that the openings be provided with strong and suitable fenders on both ends of the span, extending, say, 150 feet above and 80 feet below the bridge; and that these fenders should rise above ordinary high water to within about a foot of the draw-span's lower chord.

CONGAREE RIVER, SOUTH CAROLINA, (UNDER SURVEY).

At the city of Columbia this river is crossed by a carriage bridge, whose bottom is 36 feet above low water, and whose spans are at least 100 feet in length. Two miles below the city the river is also crossed by the Charlotte, Columbia and Augusta Railroad, on an iron-deck bridge, whose lowest portions are about 40 feet above low water, and whose spans are at least 100 feet in length. Neither of these two bridges are provided with draw-openings, but the rapids in the river at this point will probably always compel passing boats to follow a canal near the shore end of the bridges. Passing steamers will probably be few in number, and might justly be forced to make use of hinged smoke-stacks.

* * * * * * *

Five miles above the mouth of this river, it is crossed by the South Carolina Railroad, on a deck bridge, provided with a draw of 53.5 feet clear width. This draw-span is for the present built solidly into the bridge; but is ready to be suitably mounted upon its revolving platform as soon as demanded by the interests of navigation. If the now-contemplated improvement of the river be carried out, this draw should be ready for actual use in 1886. The current of this river at this point is swift and strong, especially at high stages of water. I therefore recommend that this bridge be permitted to remain for the present in its present condition, provided that when navigation is opened, the bridge-owners will suitably finish the mounting of its present draw-span, and that the openings be provided with strong and suitable fenders on both ends of this span extending, say, 75 feet above and below the bridge, and rising above high water to within about a foot of the draw-span's bottom chord.

As far as I know, these three bridges are the only ones that obstruct the navigation of the Congaree River.

W. H. BIXBY,
Captain of Engineers.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., January 19, 1885.

GENERAL: In compliance with the provisions of the second and third clauses of section 2 of the last river and harbor act, promulgated in General Orders, No. 13, Headquarters Corps of Engineers, U. S. Army, Washington, D. C., July 23, 1884, I have the honor to report as follows:

First. The Charleston and Savannah Railroad Company is now replacing a wooden bridge over the Ashley River, about 12 miles above the city of Charleston, by an iron structure. It is to be a draw-bridge, and the draw-span is believed to be ample. It is not known by what authority, if any, the wooden bridge was constructed. It is about twelve years old.

Second. A highway bridge over the Ashley River at Charleston is contemplated. It is understood that its construction will be commenced very soon. Under what authority, if any, is not known to me.

Third. A small wooden bridge at Toby's Bluff, on the Salkehatchie River, is said to interfere in some degree with raft navigation. This is a small matter, but additional information will be collected.

Fourth. The Charleston and Savannah Railroad Bridge over the Salkehatchie River has no draw-span; neither has the highway bridge, about one-quarter of a mile below it, over the same stream. These bridges offer no obstruction to raft navigation, and there is no present necessity for a draw in either bridge.

* * * * * * *

Sixth. The Savannah, Florida, and Western Railroad Bridge, over the Altamaha River at Doctor Town, Ga., has no draw. The small steamers the rebuilding of one pier on the east side of the existing channel, which has been cut through the rock, so as to make it the pivot-pier, and the substitution of a wrought-iron draw-span for the adjacent spans of the present structure. It will give an opening of 84 feet width over the existing channel, and another of the same width on the east side of the pivot-pier, available for another channel, should it be found necessary to cut it through the rock bed of the river. I am of opinion that the proposed modification of this bridge will meet the present and prospective requirements of navigation on the Coosa River. Since the transmission of former reports upon this bridge, the modificaticns mentioned in the foregoing have been commenced, and are now being made by the railroad company..

OCMULGEE RIVER, GEORGIA.

Near Lumber City, Ga., the East Tennessee, Virginia and Georgia Railroad crosses the Ocmulgee River on a bridge having a draw-spon, of which but one opening is available for navigation, and this has a width at low water of 40 feet, with good approaches above and below. In time of freshets, cross-currents in this channel render caution necessary in passing it. No complaint is made by steam-boat men, but whenever the bridge is rebuilt or extensively repaired, the pivot-pier should be shifted in position so as to give a clear span of 75 feet over the best portion of the river channel. About one-half mile above Hawkinsville the same railroad crosses the Ocmulgee River, on a wooden Howe truss bridge, about 25 feet above low water, and without a draw. This bridge will be an obstruction to navigation, as the improvement of the river is in contemplation as high up as Macon, Ga. The remedy is the introduction of a draw-span, with not less than 60 feet clear opening. About 6 miles below Macon the same railroad again crosses the Ocmulgee River, on a wooden Howe truss bridge, reported to be about 15 feet above low water. This will prove an obstruction to navigation when the river is improved as far as Macon, Ga., and a draw-span should be put in, with not less than 60 feet clear width.

OCONEE RIVER, GEORGIA.

A wooden Howe truss bridge of the Central Railroad of Georgia crosses this river about 30 miles above Dublin, the present head of navigation. As the improvement of the river above this point is in contemplation, this bridge, which is reported to be about 25 feet above low water and without a draw, will be an obstruction to navigation. The remedy should be the building of a draw next the right bank of the river, with not less than 60 feet clear span.

FLINT RIVER, GEORGIA.

The navigation of this river is obstructed, at a point 30 miles below Montezuma and opposite the town of Drayton, by a lattice wagon bridge, which contains no draw and is not at a sufficient elevation. The remedy is the introduction of a draw of suitable width, with sheer-booms if necessary. Within the corporate limits of the town of Albany three bridges cross the river, namely, Brunswick and Western Railroad Bridge, the Savannah, Florida and Western Railroad Bridge, and a wooden lattice wagon bridge. The remedy in each case is the introduction of a draw of suitable width, with sheer-booms if necessary.

Opposite the town of Bainbridge, Ga., an iron bridge with a draw crosses this river, and may require the use of sheer-booms after navigation has been opened to Albany.

CHATTAHOOCHEE RIVER, GEORGIA AND ALABAMA.

Two bridges cross this river at the town of Eufaula, which during high water are obstructions to navigation. One of these is a lattice wagon bridge, and the other the Southwestern Railroad Bridge. The remedy in each case is the introduction of a draw of suitable width, with sheer-booms if necessary. At the town of Fort Gaines, 35 miles below Eufaula, a lattice wagon bridge crosses the river, which is an obstruction to navigation in high water. The remedy is the introduction of a draw of suitable width, with sheer-booms if necessary.

ALABAMA RIVER, ALABAMA.

A wagon bridge crosses this river at the town of Selma. It is provided with a draw-span having one available opening for navigation. The location of the bridge and of the draw-span are badly chosen, and the draw seems to require supplementary works to assist the passage of boats through it. The matter is under consideration by a Board of Engineers appointed for the purpose.

CAHABA RIVER, ALABAMA.

Navigation is obstructed by the Selma and New Orleans Railroad Bridge, at a point about 8 miles above the mouth of the river, and by the Alabama Central Railroad Bridge, at a point about 21 miles above its mouth. Each of these bridges has been built without a draw, and the remedy in each case is the provision of a suitable draw, with opening sufficient for navigation, and with sheer-booms if necessary.

CHOCTAWHATCHIE RIVER, FLORIDA AND ALABAMA.

The navigation of this river is obstructed by a wagon bridge, near Geneva, Ala., about 20 feet above low water, and so constructed that it can not be modified. It should be taken down. The navigation of the river is also obstructed by a similar bridge 7 miles below Newton, Ala., which must also be removed if the improvement of the river is carried to that point.

Very respectfully, your obedient servant,

R. L. HOXIE,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN ERIC BERGLAND, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., December 9, 1884.

SIR: In compliance with General Orders, No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, I have the honor to submit the following report on bridges and other structures now erected or in process of erection which do or will interfere with free and safe navigation of certain streams within my district, with recommendations as to the best mode of altering or constructing such bridges or structures so as to prevent any such obstructions:

BIG BLACK RIVER, MISSISSIPPI.

(1) A railroad bridge is now in process of erection by the Louisville, New Orleans and Texas Railway, about 15 miles above the mouth, to replace a light iron bridge heretofore used at this crossing.

The new bridge is an iron truss, of three fixed spans. The lower side of the bottom chord is at the height of extreme high water, which is about 38 feet above low water. The end spans are 75 feet long, and center span 125 feet. The two channel-piers are iron cylinders filled with masonry. The bridge was authorized by act of State legislature, in 1872. It forms an obstruction to free and safe navigation at all stages of water. Another pier should be put in, and the center span made a pivot-draw.

(2) A county bridge at Hawkinson's Ferry, 25 miles above the mouth. This should be changed into a draw-bridge.

(3) A county bridge at Baldwin's Ferry, 78 miles above the mouth. This should be changed into a draw-bridge.

(4) A railroad bridge, erected by the Vicksburg and Meridian Railway, near Smith's Station, 90 miles above the mouth. It is a "Howe truss," of five fixed spans, 56 feet each, with the bottom chord 7 feet above extreme high water and 32 feet above low water.

The bridge was authorized by act of State legislature in 1865. It forms an obstruction to free and safe navigation at all stages of water. One of the piers should be replaced by a pivot-pier and two of the spans by pivot-draw.

Five thousand dollars have been appropriated for the improvement of Big Black River.

SOUTH FORKED DEER RIVER, TENNESSEE.

(1) A log loom, built of piles, at Hosier Mill, about 100 miles above the mouth. The opening through this should be enlarged.

(2) An old railroad bridge, erected by the Narrow Gauge Railway Company, 108 miles above the mouth. This should be removed entirely, being no longer used.

(3) A county bridge at Sharon's Ferry, 114 miles above the mouth. This should be changed into a draw-bridge.

(4) A brush dam, 13 miles below Bell's Station and 130 miles above the mouth. This should be removed entirely, as it deflects the main body of the river into an artificial channel for the use of private parties.

(5) A railroad bridge, erected by the Louisville and Nashville Railway, near Bell's Station, 142 miles above the mouth. This is a pile trestle, and should be replaced by a pivot-draw.

(6) A county bridge, 145 miles above the mouth. This should be changed into a draw-bridge.

(7) An old county bridge at Poplar Corner, 160 miles above the mouth. This should be removed, being no longer used.

(8) A county bridge at Campbell's Landing, 191 miles above the mouth. This should be changed into a draw-bridge.

(9) A county bridge at McClannahan Landing, 194 miles above the

mouth and 1 mile below Jackson, the head of navigation. This should be changed into a draw-bridge.

Five thousand dollars have been appropriated for the improvement of South Forked Deer River.

Very respectfully, your obedient servant,

ERIC BERGLAND,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR O. H. ERNST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., January 30, 1885.

GENERAL: In compliance with the instructions contained in General Orders, No. 13, dated Headquarters Corps of Engineers, July 23, 1884, I have the honor to report as follows upon the subject therein referred to:

* * * * * * *

2d. Whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstructions.

The only case of this kind in my district is the steel arch bridge at Saint Louis, which, on account of its arched form, does somewhat impede navigation at the higher stages of the river. The evil is not very serious, as the lower-river boats can temporarily dispense with going above the bridge and the upper-river boats from going below it during the short periods when the passage is obstructed. There is no remedy, for I take it for granted that this magnificent structure is not to be pulled down.

3. There are no bridges in my district having draw-spans or raft-spans.

Very respectfully, your obedient servant,

O. H. ERNST,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR A. MACKENZIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., December 12, 1884.

GENERAL: General Orders, No. 13, Headquarters Corps of Engineers, current series, requires a report upon certain facts referred to by sections 2 and 8 of the river and harbor act of July 5, 1884.

* * * * * * *

The information asked for in connection with section 2 is desired for presentation to Congress during present session. I would therefore submit herewith a report upon the matters referred to in that section:

* * * * * * *

There are on the Upper Mississippi numerous bridges, causeways, and other structures in form of piers, wharves, booms, etc., erected by private parties, which interfere with free and safe navigation. Some of these structures have been erected in accordance with acts of Congress, some by authority of State and municipal legislation, and many without any other authority than the private necessities of those building.

The trouble as regards bridges will be partially corrected by the exercise of the authority granted by section 8, river and harbor act of July 5, 1884, but as full protection to the interests of navigation as the circumstances of the case permit can only be secured by constructions in accordance with proper plans.

Section 5254, Revised Statutes, provides for the erection of piers, cribs, etc., under the direction of the Secretary of War, but while a large number of such piers and cribs have been built, I do not call to mind a single instance in which the authority of the Secretary of War has been requested.

Theoretically, private individuals or corporations injured by such structures as are here referred to are protected by law, but experience has shown that practically the laws, in their present form, do not give full protection to the interests of navigation.

The only practical method I can suggest for correcting or reducing the evils resulting from the construction of bridges, piers, booms, etc., on the Upper Mississippi is to declare all such structures as now exist without the authority of Congress, and interfere with free navigation, to be public nuisances, and to prohibit in the future all such constructions as would encroach upon the bed of the river until the same are sanctioned by general or special legislation of Congress.

Such laws would permit in each case a proper consideration of plans in advance of construction.

Very respectfully, your obedient servant,

A. MACKENZIE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORTS OF MAJOR A. M. MILLER, CORPS OF ENGINEERS.

(1) WABASH RIVER, INDIANA AND ILLINOIS.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., November 18, 1884.

GENERAL: In accordance with instructions contained in General Orders, No. 13, Headquarters Corps of Engineers, U. S. Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report on the bridges crossing the Wabash River, Indiana and Illinois:

The portion of the Wabash River for the improvement of which appropriations have from time to time been made by acts of Congress, and which is considered navigable, lies between La Fayette, Ind., and the mouth of the river. On this portion of the river, a distance of 214.6 miles, there are twenty-one bridges. Six of these are complete obstructions to navigation by steam-boats at and above a medium stage of water, and may be classified under section 2 of the act approved July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes.

* * * * * * *

They are as follows:

(1) *The Main Street Bridge at La Fayette, Indiana.*—This bridge has a clearance at low water of 31 feet; it is a highway or wagon bridge, has three spans, 175 feet 6 inches, 179 feet, and 175 feet 11 inches in length; no draw.

(2) *The Lake Erie and Western Railroad Bridge, La Fayette, Indiana.*—This bridge has a clearance of 31.5 feet at low water; it is a railroad bridge, has four spans of 158 feet 6 inches in width; no draw.

(3) *Wabash, Saint Louis and Pacific Railroad Bridge, Attica, Indiana.*—This bridge is a railroad bridge, has a clearance of 37.5 feet at low water, twelve spans, varying from 104 feet 10 inches to 151 feet in width; no draw.

(4) *Chicago and Great Southern Railroad Bridge, Attica, Indiana.*—This bridge has a clearance of 33.5 feet at low water, is a railroad bridge, has six spans of 144 feet; no draw.

(5) *Indiana, Bloomington and Western Railroad Bridge, Covington Indiana.*—This bridge has a clearance of 31.5 feet at low water, is a railroad bridge, has four spans from 142 to 144 feet in width; no draw.

(6) *Columbus and Saint Louis Railroad Bridge (narrow gauge), near Lodi, Indiana.*—This bridge has a clearance of 29 feet at low water, is a railroad bridge, has five spans of about 160 feet each; no draw.

All the above bridges require, to render them no obstruction to navigation, to be supplied with draw-spans, placed over the high-water channel, having a width in the clear of 60 feet, and so arranged as to be managed with rapidity and facility. As they now stand, they are at a medium stage of water (8 feet) complete obstructions to navigation by small steam-boats, and at high water are obstructions sometimes to rafts and flat-boats. In the spring of 1884 the water was up to the bottom chords of some of the higher bridges, and the lower ones were partly submerged.

A recapitulation is given in tabulated form:

Bridges classified under section 2 of the act approved July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, which "now erected or in process of erection do or will interfere with free and safe navigation."

No.	Bridge.	Location.	Clearance at low water.	Proposed alterations.
			Feet.	
1	Main Street Bridge (wagon-way)	La Fayette, Ind	31.0	These bridges require, to render them no obstruction to free navigation, to be supplied with draw-spans placed over the channel, having a width in the clear of at least 60 feet, arranged to be maneuvered with facility and rapidity, with proper guide-dikes or guard-piers.
2	Lake Erie and Western Railroad Bridge (railway)	do	31.5	
3	Wabash, Saint Louis and Pacific Railroad Bridge (railway)	Attica, Ind	37.5	
4	Chicago and Great Southern Railroad Bridge (railway)	do	33.5	
5	Indiana, Bloomington and Western Railroad Bridge (railway)	Covington, Ind	31.5	
6	Columbus and Saint Louis Railroad Bridge (railway)	Near Lodi, Ind	29.0	

In addition to the bridges mentioned above there are two other railroad bridges crossing the Wabash River: (1) The Ohio and Mississippi Railroad Bridge, at Vincennes, Ind.; (2) the Louisville and Nashville Railroad Bridge, at Grand Chain, Ill., 31 miles above the mouth of the Wabash.

These two bridges are provided with ample draw-spans, with draws in good working order, and suitable guide-piers.

Sketches* showing location and proposed alteration of bridges are forwarded herewith.

Very respectfully, your obedient servant,

A. M. MILLER,
Major, Corps of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

WHITE RIVER, INDIANA.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., December 20, 1884.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report on the bridges crossing the White River, Indiana:

Appropriation for the improvement of White River, Indiana, was first made by act of Congress approved March 3, 1879, and this act and those subsequent, making appropriations until the act of July 5, 1884, directed the appropriation to be expended in improving the river "from Wabash River to Portersville and to falls on West Fork."

The act approved July 5, 1884, makes appropriation for improving White River, Indiana, below Hazleton.

There are at present no bridges below Hazleton on the White River, but, as appropriations for improving the river as far as Portersville have been made, it is considered proper to report on the bridges below Portersville.

There are two bridges on the White River between Portersville and the Wabash River: (1) The Evansville and Terra Haute Railroad Bridge, which crosses the river near Decker's Station, about 2½ miles above Hazleton; (2) the Evansville and Indianapolis Railroad Bridge, which crosses the river just above the mouth of the West Fork.

The Evansville and Terra Haute Railroad Bridge has four permanent spans of 137 feet in the clear and a draw-span 54 feet wide between piers. The height of lower chord above water (low) December 5, 1884, was 29 feet. The draw consists of two cranes, each carrying one of the rails, and is maneuvered by swinging these cranes up-stream. The draw is situated on the convex bank of the river, over the shoalest part. At the time of the examination, December 5, 1884, this bar was 3 feet above the water surface, thus requiring a rise of 10 feet to render the draw available for navigation. The bridge as it now stands is a complete obstruction to navigation at a fair boating stage. The draw should be placed at the other extremity of the bridge, with proper guard-piers and method of maneuvering. A sketch* showing present situation of the draw and bar is appended, marked A.

The Indianapolis and Evansville Railroad Bridge crosses the East Fork of the White River just above the mouth of the West Fork. This bridge crosses the river on the piers of the old canal aqueduct, with four spans of 84 feet and one of 175 feet. Under the center of this last span are the ruins of one of the old aqueduct piers. The height of lower chord above water surface (low) December 6, 1884, was 34 feet 7 inches. The bridge has no draw. The bridge is a bad obstruction to navigation. The piers, being only 84 feet apart, catch large quantities of drift at high stages of water, and the absence of a draw renders the bridge a complete obstruction at navigable stages. The bridge should have a draw placed in it over the channel. A sketch* of bridge is appended, marked B.

---

* Sketches omitted.

Very respectfully, your obedient servant,

A. M. MILLER,
Major, Corps of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

GASCONADE RIVER, MISSOURI.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., January 8, 1885.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report on the bridges crossing the Gasconade River, Missouri.

The only bridge crossing the Gasconade River which can be considered an obstruction to navigation is the Missouri Pacific Railway Bridge, crossing the river at a point about 4,000 feet above its mouth or confluence with the Missouri River. The axis of the bridge is oblique to the direction of the stream, making an angle of about 60 degrees with the direction of the river. The piers of the bridge are built with their axes parallel to the thread of the current. There are six spans, of the following widths, beginning with the east span:

	Feet.
No. 1	$123\frac{1}{8}$
No. 2	$141\frac{5}{24}$
No. 3	$74\frac{2}{3}$
No. 4	$74\frac{1}{12}$
No. 5	141
No. 6	$129\frac{5}{8}$

The center pier is intended for a swing-draw, the spans on either side being 74 feet 8 inches and 74 feet 1 inch, but these spans are bridged by permanent trusses. The height of the lower chord of the bridge above low water is 32.83 feet.

The bridge is at present an obstruction to the navigation of the river by steam-boats. The draw-span should be made operative, and a guide pier or dike be built above and below the pivot-pier.

A tracing† showing plan of piers and down-stream elevation of bridge is inclosed.

Very respectfully, your obedient servant,

A. M. MILLER,
Major, Corps of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

---

* Sketch omitted.

† Tracing omitted.

REPORT OF MAJOR CHARLES J. ALLEN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Saint Paul, Minn., December 1, 1884.

GENERAL: I have the honor to submit the following report in obedience to General Orders, No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, requiring information necessary to comply with the requirements of sections 2 and 8 of the river and harbor act of Congress approved July 5, last.

* * * * * * *

SAINT CROIX RIVER, MINNESOTA AND WISCONSIN.

The principal obstructions to navigation on this stream consist of lines of piling to carry sheer-booms, and loose logs floating down-stream. The St. Croix Boom Company use the river for collecting and distributing boom-grounds for some 7 miles above Stillwater. During the early part of the season of navigation, the river for about 5 miles of this distance is entirely filled with logs, which at times prevent any navigation of the river by steamers and barges, and until the logs are rafted and distributed, steamers have to take inadequate side channels on the east side of the river. This obstruction continues, during some seasons, for sixty days. Even when the booms are nearly emptied of logs, the lines of piles driven to direct the logs into the booming-grounds are great obstructions.

Lumbering is the great interest on the St. Croix River, overshadowing all others; but the lines of piling and booms should be so arranged as to admit of the booms occupying one side of the river, leaving a channel on the other side for steamers and barges.

CHIPPEWA RIVER, WISCONSIN.

At Round Hill, about 20 miles above the mouth of the river, the Beef Slough Logging Company (a corporation engaged in the driving and assorting of saw-logs) have had for many years a line of boom-piers to support a sheer-boom that directs all floating logs to the left bank of the river, leaving only a passage between the end of the boom and the rocky shore on the left bank of about 130 feet. About one-half mile below this boom is a structure of brush and stone, jutting out from the head of Beef Island, to aid in deflecting logs into the "sorting" grounds in Beef Slough; and at the lower end of Beef Island is a dam connecting the island with the left bank, just below the entrance to Beef Slough, to further aid in turning logs into the slough. About 1½ miles below Beef Island is another boom, for the purpose of sheering logs into Little Beef Slough. (See sketch.) These works are entirely in the interest of what is called loose-log navigation, and opposed to steam-boat and rafting interests, the booms at times blocking up the channels more or less against the passage of rafts. A conflict has existed for years in regard to these booms between the rafting and steam-boat and logging interests.

Assistant Engineer V. D. Simar reported November 5, for the season of 1884, in regard to these works:

> No complaints of obstructing navigation have thus far been made, to my knowledge. Further encroachments upon the channel by the construction of additional piers should not be allowed, the piers now occupying more space than they should.

About the 1st of July last, the Beef Slough Company drove a number of piles in the Chippewa River, at a point about three-fourths of a mile above its mouth and on the left bank, to form a pocket for the purpose of collecting logs to be sheered into it by a boom on the right bank of the river, and about 400 feet above the pocket. Complaint was made by the Knapp, Stout & Co. Company, a corporation largely engaged in the manufacture and rafting of lumber, they alleging that the boom and piling endangered raft navigation. An examination of this locality was made by Assistant Engineer A. O. Powell, who reported, July 7, that the encroachments of the logging company were jeopardizing the interests of the lumber-manufacturing firms in the Chippewa Valley. The treasurer of the logging company was communicated with at once, by telegraph, and answer returned by him that he would remove the boom and piling if they were in any sense obstructions. He was requested on the 14th to remove them. Subsequently, he called at this office and requested me to personally examine the ground before insisting upon their removal. I examined the works in September, when the stage of water was high, at which time the piling presented no obstruction to rafts or steamers. As the water lowered, the channel shifted towards the group of piles, and complaints against them were renewed. A portion of the piling was removed by parties employed, as I was informed, by the Knapp, Stout & Co. Company. On the 14th of November, I wrote to the treasurer and manager in general of the Beef Slough Company, requesting him to fulfill his promise, and learned from Assistant Simar that orders had been issued by the manager of the company for the removal of the obstructions.

HARBOR OF DULUTH, MINNESOTA.

Assistant Engineer J. H. Darling reports in relation to this harbor as follows:

In compliance with your orders dated July 31, 1884, relating to * * * obstructions to safe navigation, I have to report as follows:

* * * * * * *

As to obstructions to channels, I have observed rafts lying in the main-harbor area of Duluth for three or four days at a time, while the logs composing the raft, and owned, I believe, by one F. R. Webber, were being run under the "bridge" one by one to the Taylor & Fray saw-mill. I have observed such raft twice since I came to Duluth (in August).

On the first occasion I took no measurements of its extent, but it extended into the harbor so as to be much in the way of vessels moving about. The second raft noticed by me was brought there about September 19. On that date (according to Inspector Kinnaird) it extended 200 feet into the harbor beyond line of private dredging, or 350 feet from dock-line and about 500 feet along dock-line. On September 21 I found the same raft to be there, but reduced in size, so that it extended about 225 feet from the dock, or 75 feet beyond line of private dredging and 500 feet along the dock and bridge. I am told that these rafts are sometimes in the way for a whole week at a time.

BRIDGES.

Northern Pacific Railroad Company's bridge across the Red River of the North at Moorhead, Minnesota, and Fargo, Dakota.—The Northern Pacific Railroad Company recently renewed its bridge across the Red River of the North at Fargo and Moorhead, constructing it so as to afford a draw-opening of 60 feet width. Complaint having been made during the past summer of a number of piling left in the river so as to contract the draw-span, and also that necessity existed for the placing of sheer-booms to aid in the passage of the draw by steamers and barges, the general manager of the company was communicated with on the subject. He promptly caused the removal of the obstructions and had constructed and placed proper floating sheer-booms above and below the pier, aggregating in length 280 feet.

There are other bridges spanning the navigable waters within the district over which I have charge that may in time need modification, sheer-booms, etc., in the interest of navigation. The provisions of section 8, river and harbor act approved July 5, can be applied to such bridges when necessity arises.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR W. R. KING, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., January 24, 1885.

GENERAL: In compliance with General Orders No. 13, Headquarters Corps of Engineers, July 23, 1884, I have the honor to submit the following report relative to bridges, booms, etc., which obstruct navigation in the Tennessee and Cumberland rivers and their navigable tributaries:

(1) Under the supposition that pilots and steamboat-men would, from their occupations and interests, be the best authorities on the obstructions met with in navigating these rivers, circular letters were at an early day addressed to a considerable number of the most prominent ones, requesting such information as they or their acquaintances could furnish, and the maps and records of this office, as well as of several railroad offices, have been consulted for the purpose of obtaining all available data relative to the several bridges that formed the subject of investigation.

From the information thus obtained the following tabular statement* has been made:

* * * * * * *

showing the location of the bridges and such facts concerning their structure as could be collected up to the present time.

In considering the question as to whether any given structure is an obstruction to navigation within the meaning of the act of Congress under which this inquiry is made, it seems proper to take note of the fact that most, if not all, of the bridges have been built under State laws, while Congress either approved or was silent on the subject, and this fact, in view of the recent decision of the Supreme Court, to the effect that, Congress being silent, State action must be held legal, would seem to call for a very conservative course in regard to recommending the removal or alteration of bridges, except in cases where the extent of the inconvenience or obstruction to navigation is so great as to leave no doubt as to the justice and necessity for decisive action.

If the bridges were merely projected, instead of being actual structures, it is not probable that more than half a dozen on the list would be approved without some modification of plan or location, but under existing circumstances there are but three of them that appear to demand attention as obstructions within the meaning of the law, viz:

First. The Memphis and Charleston Railroad bridge over Tennessee River at Florence, Ala., which has hitherto been at the head of navigation, but which on completion of the Muscle Shoals Canal will be a barrier to navigation, as it has no draw, and is so low that the larger class of steam boats will not be able to pass even by lowering their pipes. This bridge is on a mere branch road, and is a slender structure, both as to masonry and frame, and, judging from the extreme care with which trains are run over it, either a new bridge or extensive repairs will be needed in the near future.

---

* See table with supplementary report herewith.

On account of its short spans and location with reference to the current, which is quite strong at that point, two of the piers should be removed, and a single pivot-pier for the draw substituted for them. As the bridge carries a common road on the lower chords and a railroad on the upper, a two-story draw will be required, and I would respectfully recommend that the company be requested to make these changes during the next low-water season. The probable cost of the necessary changes to this bridge would doubtless exceed the $15,000 limit, and might reach $50,000.

Second. The bridge of the Nashville, Chattanooga and Saint Louis Railroad over the Tennessee River at Johnsonville, Tenn., is a serious obstruction, owing to the faulty location and construction of the draw, and serious damage has resulted to passing steam-boats, one or more having been sunk in consequence. The foundations of the draw-piers having been carelessly put in, the river has undermined them, and to prevent this the company has dumped in a large mass of loose stone, which still further narrows the already insufficient channel, and causes troublesome sand-bars to form below the bridge.

I would respectfully recommend that the railroad company be requested to rebuild this draw and widen it, to give a clear width of 125 feet, which, in connection with some contemplated work on the improvement of the channel at that point by the United States, would effectually dispose of this obstruction.

The probable cost of the proposed changes to the bridge would be about $30,000.

Third. The bridge of the Chesapeake, Ohio and Southwestern Railroad across the Tennessee River at Gilbertsville, Ky., is also a serious obstruction, chiefly owing to the fact that one of the "rest-piers" for the draw has fallen into the river, and the other is located too near the channel. It is reported that the draw never actually rests upon this pier, and, unless the company wishes to remove and rebuild it in the proper place, I would respectfully recommend that it be torn down and used, with the remains of the one already down, for building wing-dams, or otherwise, in connection with the river improvement, making no charge against the railroad company, nor allowing them anything for the stone, in case they decline to promptly remove them.

Fourth. The bridge across the Hiawassee River at Charleston, Tenn., owned by the East Tennessee, Virginia and Georgia Railroad Company, has no draw, and is so low that none but the smallest steam-boats can pass under when there is sufficient water in the stream for a good navigation.

I presume the law would compel the company to put in a draw, but owing to the small amount of steam navigation necessary for commerce above Charleston, and to the fact that a draw to be opened perhaps half a dozen times a year would be nearly as great an inconvenience and possible cause of accident to railway travel as a draw on some stream with a hundred times the commerce, it is doubtful whether I would be justified in recommending that the company be required to put in a draw at this place. I have heard no complaint in regard to this bridge for several years, which in a negative way goes to show that there is no great demand for a draw. These remarks apply also to the Louisville and Nashville Railroad Bridge over Red River at Clarksville, Tenn.

Other bridges, notably those at Bridgeport and Decatur, Ala., have very narrow draws, but, for reasons already stated, I do not feel justified in recommending their alteration, especially as they are both new bridges, and the work of enlarging the draws would be out ot all proportion to the advantage gained.

As the railroad companies owning these and other bridges that have narrow or badly located draws will doubtless construe any failure to report them as obstructions under the law into an approval of the bridges as they stand, I would respectfully suggest that the owners of *all* the bridges on the Tennessee and Cumberland rivers having draws less than 125 feet, clear width, be formally notified that the bridges are obstructions, and that, in case of rebuilding or extensive repairs, they will be required to make the necessary provisions for "free and safe navigation."

The *log-booms* near Point Burnside, Kentucky, in the forks of the Cumberland River, are complained of by raftsmen, and all the action needed to remove these obstructions would be to direct the owners to take them away, or, at least, to confine them to one side of the stream and remove the branch that crosses the channel.

An indirect complaint in regard to these booms was made some weeks ago, and I requested that interested parties would forward written statements of the inconvenience they had been subjected to, but no reply has been received as yet.

Another drift-catching boom across one of the channels in the Cumberland River, about 20 miles above Nashville, has been complained of, and I have taken steps to ascertain the exact extent of the obstruction, but as it is not across the main channel I am inclined to think that it will prove an advantage to navigation, by closing one chute and compelling steam-boats to take the same course at all times, which will tend to keep the channel free from sand-bars.

* * * * * * *

Very respectfully, your obedient servant,

W. R. KING,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

SUPPLEMENTARY REPORT.

UNITED STATES ENGINEER OFFICE,
Chattanooga, Tenn., February 3, 1885.

GENERAL: Since my report of the 24th ultimo was forwarded, some additional facts relative to obstructions by bridges, etc., have been received, and I would respectfully request that the following statement be added to, and made part of, the report already submitted:

(1) The inclosed tabular statement is more complete than the one forwarded, and is intended to supersede it in the report.

(2) A recent accident at the Clarksville Bridge, on the Cumberland River, has moved the pilots and others interested in the navigation of that river to demand that the space between the draw-piers be filled in by a solid wall, so that boats may rub against it without damage, and that a pole 30 to 50 feet high, bearing a red flag by day and a red lantern by night, so that pilots may see at a reasonable distance whether

the draw is open, be erected upon the draw-span. This request seems reasonable, and as the cost to the company would not be very great, I would respectfully recommend that the necessary orders be given. It may be that cribs of timber filled with stone would answer as well as solid stone-masonry, and the cost need not exceed $5,000 or $6,000.

(3) The purchase of a new steam-boat to trade on the Tennessee River between Chattanooga and the head of Muscle Shoals, and the prospect of the completion of the canal around the shoals at an early day, which will bring other steamers of large dimensions into these waters, seem to demand that my recommendation relative to the bridges at Decatur and Bridgeport should be modified, and I would respectfully recommend that the Memphis and Charleston and Nashville and Chattanooga Railroad companies be required to widen the draws of the bridges in question within the the next eighteen months, so that there shall be 120 feet clear space available for navigation. The cost would probably exceed $15,000 in each case, but to make a close estimate would require data not now available.

Very respectfully, your obedient servant,

W. R. KING,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

Tennessee and Cumberland rivers and their tributaries.

Location of bridge.	Owner of bridge.	Number of spans.	Average length of spans available.	Width of draw.	Height above low water.	Height above high water.
			Feet.	*Feet.*	*Feet.*	*Feet.*
Tennessee River at—						
Knoxville, Tenn....	County	8	207	None	62.5	19
Knoxville, Tenn....	E. T., Va. and Ga. R. R ..	8	150	None	61½	26⅓
Loudon, Tenn.......	E. T., Va. and Ga. R. R ..	10 deck, 1 thro'.	153	None	75	....
Chattanooga, Tenn..	C. S. R. R	9	260	125	64	10⅓
Bridgeport, Ala.....	N. and C. R. R	5	140	65⅓	36⅓	—4
Decatur, Ala.	M. and C. R. R............	12	154½	53⅓	32⅓	3.1
Florence, Ala.......	M. and C. R. R., and carriage.	17	100	None	83⅓	1⅓
Johnsonville, Tenn	N. C. and Saint Louis and N. and C. R. R.	9	164	*97	47	2
Danville, Tenn	L. and N. R. R	6	175	98	....	....
Gilbertsville, Ky....	Chesapeake, Ohio and S. W. R. R.	9	169	100	56.3	0.6
Cumberland River at—						
Burnside, Ky	C. S. R. R	3	180	None	125	....
Nashville, Tenn	City	....	200	None . .	92	37
Nashville, Tenn.....	L. and N. R. R............	2	200	106	66.6	....
Clarksville, Tenn...	L. and N. R. R............	2	200	90	72	....
Eureka, Ky........	Chesapeake, Ohio and S. W. R. R.	3	150	93 at low and 120 at high water.	65	....
Holston River, at Strawberry Plains	E. T., Va. and Ga. R. R..	....	....	....	....	....
French Broad River, at Leadvale, Tenn.	E. T., Va. and Ga. R. R. (branch.)	....	....	....	....	....
Hiawassee River, at Charleston, Tenn.	E. T., Va. and Ga. R. R..	3	120	....	36	....
Clinch River, at Clinton, Tenn.	E. T., Va. and Ga. R. R. (branch.)	2	150	....	50	....
Duck River, at Columbia, Tenn.	L. and N. R. R	....	....	....	....	....
Red River, at Clarksville, Tenn.	L. and N. R. R	....	....	....	....	....

Boom across south fork of Cumberland River, at Burnside, Ky., for catching logs.
Boom across Cumberland River, at Burnside, Ky., for catching logs.

*Pilot Louis Pell gives 84 feet, and Jas. Till and Sam. Briscoe give 80 feet—25 feet of riprap=55 feet.

REPORT OF LIEUTENANT-COLONEL WILLIAM E. MERRILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, Ohio, February 5, 1885.

GENERAL: In accordance with instructions contained in General Orders No. 13, Headquarters Corps of Engineers, Washington, July 23, 1884, I have the honor to submit the following report:

The subjects on which I am required to report are the following:

* * * * * * *

(2) Whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and, if they do or will so interfere, to report the best mode of altering or constructing such bridges, or causeways, so as to prevent any such obstructions.

There are many such cases in this district, and I will answer this query in detail. It is necessary to premise that the rivers under my charge are the Ohio, the Monongahela, the Allegheny, and the lower end of the Muskingum.

My remarks will be limited to "bridges," as there are no "causeways" or "structures" to be reported.

BRIDGES OVER THE OHIO RIVER.

These bridges have been an object of care and legislation by the General Government ever since the first one was built, and the only cases in which interference is now necessary are those in which bridge companies have failed to comply with the recommendations of the Boards of Engineers who examined and reported on the plans prior to their erection.

* * * * * * *

BRIDGES OVER THE MONONGAHELA RIVER.

The following table gives a statement of all the bridges over so much of the Monongahela River as is now navigable:

Place and class of bridge.	Distance above mouth.	No. of spans.	Channel-span. Clear width on low-water line.	Channel-span. Clear height above low water.	Name of pool in which located.
	Miles.		*Feet.*	*Feet.*	
Point, highway	0	1	780	73.3	Davis Island Dam.
Smithfield street, highway	0.8	2	344	55	Do.
P., C. and T. L. R. R	1.0	5	247.4	53	Do.
Tenth street, highway	1.3	8	195	54	Do.
B. and O. R. R. (Glenwood)	6.0	8	104 184	59 57	No. 1, Monongahela River.
P., McK. and Y. R. R. (Homestead)	8.0	6	250	54	Do.
P. R. R. (Port Perry)	11.8	9	253	57	Do.
P., McK. and Y. R. R. (McKeesport)	15.5	6	221	40	In No. 2, Monongahela River, over mouth of Youghiogheny.
Monongahela City, highway	32.5	4	216	33	No. 3, Monongahela River, burnt.
O. and B. S. L. R. R. (Greenfield)	52.0	4	238	52	No. 4, Monongahela River (unfinished.)
P. R. R. (Redstone)	56.0	4	262	40	No. 4, Monongahela River.
Brownsville, highway	57.3	8	218	41.5	Do.
Morgantown, highway	102.0	1	606	45.7	No. 9, Monongahela River.

Of the bridges included in this table, one of the two lowest is the one at McKeesport, over the mouth of the Youghiogheny. In view of the fact that there is now no navigation on this stream, except such as is afforded near its mouth by backwater from Dam No. 2, on the Monongahela, it does not seem necessary to take any action towards having this bridge raised, but such raising would become a necessity in case the locks and dams that once existed on the Youghiogheny were ever rebuilt.

The new bridge at Redstone and old National Road Bridge at Brownsville are now the chief obstructions on the Monongahela, as far as head-room is concerned, although the bridge at Monongahela City (now burnt) was formerly even more objectionable. I would recommend that the standard height of bridges on the Monongahela be fixed at 45 feet above pool-level, and that the bridges at Brownsville and Redstone, and that at Monongahela City (in case it shall be rebuilt) be required to conform to this regulation.

No change seems necessary in the widths of existing channel-spans, but in future no channel-span should give less than 250 feet in the clear, and a law to that effect is recommended.

At the Pan Handle Railroad Bridge, in Pittsburgh, the channel-span is partly closed by heaps of refuse thrown out from the right bank, and the passage has become dangerous. The channel-span is the only "through" span in this bridge, all the other spans being "deck." I would recommend that the railroad company be required to transform the span adjoining the channel-span on the south from a "deck" to a "through" span, so that boats can have a second space under which to pass.

At the Tenth Street highway bridge the passage is endangered by piles of rubbish projecting from the right bank, so that it is dangerous to run this span at high water. If these piles are on ground belonging to the bridge corporation, the latter should be compelled to remove them, and to take measures to prevent their reformation in future. If on ground not belonging to the corporation, the latter can not be held liable, and the matter falls outside of the scope of this report.

At Monongahela City the left pier is directly in the channel, and should be removed, whether the bridge is rebuilt or not.

SUMMARY.

The bridges on the Monongahela which require modification, as stated above, are, therefore, (1) the Pan Handle Railroad Bridge at Pittsburgh, (2) the Monongahela City Bridge, (3) the Redstone Bridge, (4) the Brownsville Bridge; and the channel-span of the Tenth Street Bridge needs restoration to its normal width.

BRIDGES OVER THE ALLEGHENY RIVER.

The following table, prepared by Mr. I. V. Hoag, jr., assistant engineer in charge of Government work on the Allegheny River, shows the existing bridges over the Allegheny between Olean and Pittsburgh. When a * appears the figures given are estimated. Where bridges are reported as under reconstruction, the future heights and widths are given in the table.

Bridges over Allegheny River between Pittsburgh and Olean.

Place and class of bridge.	Distance above mouth.	Total length.	No. of spans.	Length of channel-spans between centers of piers.	Height in clear above low water.	Character of structure.
	Miles.	*Feet.*		*Feet.*	*Feet.*	
Union, highway	0	1,060	5	212	40	Wooden truss, with arch.
Sixth street, highway	0.5	1,036	4	346	37	Suspension.
North side (Seventh street) highway.	0.6	1,080	4	330	40.5	Stiffened suspension.
Ninth street, highway	0.7	1,044	5	209	39	Covered, wooden arch.
P. F. W. and C., railroad	0.9	1,167	9	152	38	Iron lattice truss.
Sixteenth street, highway	1.3	840	4	210	39	Covered, wooden arch.
Pittsburgh Junction Railroad (Thirty-third street.)	2.65	841.4	4	210.3 250	43	Open, iron truss.
Forty-third street, highway	3.4	980	4	244	37	Covered, wooden truss.
Sharpsburgh, highway	5.3	905	5	181	38	Open, iron truss.
Freeport, railroad	29.6	795	5	185	38	Decked, wooden arch.
Kittanning, highway	44.9	900	5	180	32.7	Iron bow-string girder.
Brady's Bend, highway[1]	69.5	750	4	200	35.7	Howe truss, wood.
Parker, highway	83.1	790	4	197	34.5	Iron bow-string girder.
Foxburgh, railroad and highway	86	530.7	3	176.9	35.3	Howe truss, wood, "through" for highway, "decked" for railroad.
Embenton, highway[2]	89.6	456	2	228	39	Open, iron truss.
Big Rock, highway	122	700	4	175	27	Wooden truss, new (1879).
Franklin, highway	123.1	711	4	175	31.5	Open, wood and iron truss.
Oil City, highway	130.2	700	3	500	41	Suspension.
Oil City, highway[3]	130.4	1,100	6	200	33	Open, iron truss, with covered sidewalks.
Allegheny Valley Railroad	130.6	450	3	150	29	Open, wood truss and arch (rebuilt in 1883).
Tionesta, highway[4]	150.6	435	4	120	25.5	Iron bow-string grinder.
Hickory, highway	156.8*	646	4	161.5	24.1	Howe truss, wood (1883).
Tidioute, highway	165.3	536	2	268	27.8	Suspension.
Philadelphia and Erie Railroad	187.1	450	3	150	18.6	Covered, wooden truss.
Warren, highway	187.7	452	1	452	24.4	Suspension.
B., N. Y. and P. Railroad	188.3*	526	3	175	18*	Howe truss, wood (1882).
Glade Run, highway	190.8*	568	4	142	19.8	Do.
B., N. Y. and P. Railroad	197.8*	634	4	158.5	22*	Do.
Onoville, highway[5]	212.4*	505	7	82	13*	Suspension (1884).
Quaker Bridge, highway	218.2	300	4	75	17.5	Wood, Queen truss.
Red House, highway[6]	224	375	3	125	20	Open, iron truss (1881).
West Salamanca, highway	230	643	4	118	20	Open, iron truss.
B., N. Y. and P. Railroad	231.1*	394	3	146	22.5*	Howe truss, wood (1883).
Salamanca, highway[7]	231.8	400	3	133½	15	Parabolic truss, iron (1883).
South Carrolton, highway	237.8*	280	6	84	17*	Wooden truss (1883).
Tuna Creek, highway[8]	239.9	274	2	137	26	Open, iron truss.
Erie R. R., Bradford Branch[9]	240.3	192	1	203	13*	Open, iron truss (1883).
Rochester and Pittsburgh R. R.	240.3	203	1	203	15*	Open, iron truss (1882).
Allegheny, highway	250.6	400	4	100	19.4	Iron bow-string girder.
B., N. Y. and P. Railroad	251.4*	329	2	164.5	16*	Howe truss, wood (1883).
B., N. Y. and P. Railroad[10]	253.7	300	3	100	20	Howe truss, wood.
Olean, highway	255	240	3	80	16.5	Iron truss.

---

[1] Superstructure gone, but the piers still remain.

[2] Destroyed by ice in February, 1883. Rebuilt same year, at an increased height of 5 feet.

[3] In process of reconstruction at an increased height of 4 feet.

[4] During 1884 one span of this structure was taken down and a new span erected on the original piers, and at the original elevation.

[5] The construction of this bridge is very primitive, consisting simply of two 2-inch wire ropes passing over piling driven into the bed of the river, from which is suspended a very cheaply constructed floor.

[6] This is a combination bridge of three spans. One span fell in 1880, a second was carried away by high water in the spring of 1881, and the third was taken down and a new structure was erected. The clear width of channel has been reduced 7 feet, and the height above low water has been reduced 1 foot.

(7) In 1883 the superstructure of this bridge was taken down, and a new one was erected on the same piers, having an increased length of channel-span of 48½ feet, and a decrease of 4.2 feet in the height in the clear over the channel.

(8) The superstructure, originally a Queen truss, of wood, is at present being removed, and a new one is in process of construction, having an increase in length of channel-span of 33 feet.

(9) The superstructure was originally a wooden Howe truss, which was taken down in 1883; and a new one was erected, having an increased length of 7 feet and a decrease in height over the channel of 1.7 feet.

(10) In process of reconstruction, without change in height or channel-span.

It is undeniable that steam-boat commerce on the Allegheny has been almost destroyed by low bridges. Formerly there was a valuable river trade between Oil City and Pittsburgh, but the great danger and difficulty of making a trip under present conditions has acted as an embargo, and the steam-boat interest on the Allegheny is practically extinguished.

In my judgment this river commerce has been illegally destroyed, and public interest requires that so magnificent a stream as the Allegheny should be restored to commerce. Since 1879 the United States has expended, under my direction, $105,000 in improving the navigation of this river, and Congress by its appropriations has classed the Allegheny among the navigable rivers of the United States. As such, navigators have a right to demand that existing artificial obstructions should be removed.

The trade on this river which should be restored is the towing trade, as there is no probability of any future passenger traffic. A large business could be developed in towing barges laden with oil in bulk, coal, limestone, staves, building stone, sand, gravel, and generally with all heavy products which railroads can not afford to handle.

Every consideration of equity requires that the same protection should be extended to the river commerce of the Allegheny as is now granted to similar commerce on the Monongahela. I would, therefore, recommend for the Allegheny, as I have done for the Monongahela, a head-room of 45 feet and a minimum channel-space of 250 feet in the clear. These conditions, however, should only apply on the river below Oil City. Above Oil City it is not now necessary to provide for steam-boats, although their wants will have to be considered whenever the Allegheny is locked and dammed, a condition which is not impending at this present although it may fairly be expected in the future. There is a necessity however, of providing for the safety of rafts and raftsmen, by requiring channel-spans to have a minimum width of 200 feet and a height of not less than 10 feet above high water.

The Union Bridge, at the mouth of the Allegheny, was built in 1874, and the effect of its construction was to destroy the ship-building and repairing interest on the Allegheny River below the Sixth Street Bridge. For a full report on this bridge, I would refer to the Annual Report of the Chief of Engineers, 1875, Part II, page 684. In that report I recommended that this bridge should be required to provide a draw-span giving two clear openings of 120 feet. The other alternative is to require the superstructure to be raised to the same height as that of its immediate neighbor, the Point Bridge, which spans the Monongahela at its mouth. The clear height under the last-named bridge, measured to the surface of the pool of the Davis Island Dam, is 73 feet.

I would therefore recommend that the owners of the Union Bridge be required by proper legislation to change their bridge so as to make it conform to either of the two plans herein outlined.

SUMMARY.

I recommend that all bridges over the Allegheny River between Pittsburgh and Oil City (except the Union Bridge) be required to have a channel-span giving a clear width between piers of 250 feet and a clear height above low water of 45 feet, and that all bridges between Oil City and Olean be required to have a channel space giving a clear width between piers of 200 feet and a clear height of 10 feet above high water. The Union Bridge across the mouth of the Allegheny should give a clear height above the pool of the Davis Island Dam of 73 feet, or else should be provided with a draw giving two clear openings of 120 feet each.

If these recommendations are carried into effect, every bridge on the river will require raising except the highway bridges at Tionesta and Tidioute. The suspension bridge at Warren should also be excepted, as it is only a few inches too low. I think that the proposed requirement as to height should be enforced, as it is comparatively easy to jack up and underpin a bridge, and deficiency in height is the most serious possible defect in the relations of a bridge to navigation.

As all of the bridges on the Allegheny have been built under State law, which contained no precise requirement as to width of channel space, I would recommend that no action be taken against any bridge between Pittsburgh and Oil City that gives a channel space of 200 feet, or against any bridge between Oil City and Olean which gives a channel space of 150 feet.

The bridges therefore that, under this recommendation, would be required to widen their channel-spans are reduced to the following: Pittsburgh, Fort Wayne and Chicago Railroad, at Pittsburgh; Sharpsburgh, highway; Freeport Railroad; Kittanning, highway; Parker, highway; Foxburgh Railroad and highway; Big Rock, highway; Franklin, highway; Allegheny Valley Railroad, at Oil City; Tionesta, highway; Glade Run, highway; Salamanca, highway; South Carrollton, highway: Tuna Creek, highway; Allegheny, highway; Buffalo, New York and and Philadelphia Railroad; Olean, highway.

BRIDGE AT MOUTH OF MUSKINGUM RIVER.

The Baltimore and Ohio Railroad Bridge spanning this river near its mouth has no draw on the side where the United States is building a large lock, for the purpose of enabling steam boats and barges to enter Pool No. 1 of the Muskingum River for safety from ice in the Ohio.

This draw is not now necessary, but it will become so when the lock in question is completed and the State lock on the Harmar side is removed. The draw should be so built that the free space between the pivot-pier and the present eastern abutment of the bridge would not be less than 80 feet.

* * * * * * *

Respectfully submitted.

Wm. E. Merrill,
Lieut. Col. of Engineers.

Brig. Gen. John Newton,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

United States Engineer Office,
Baltimore, Md., October 30, 1884.

General: In compliance with the instructions of General Orders, No. 13, July 23, 1884, Headquarters Corps of Engineers, I have the honor to submit the following "final report" on the subject therein referred to:

ELK RIVER, WEST VIRGINIA.

The old lock and dam near Charleston, West Virginia.—In the Annual Report of the Chief of Engineers for 1876 page 167, Part II, it is stated; "A poor dam and lock, badly located, have been built about 2½ miles above Charleston, under State authority; these should be removed." Reference may also be made to my report and that of Captain Ruffner to me, and the letters and indorsements published therewith, in the Annual Report of the Chief of Engineers for 1882, pages 931 to 934, Part I. The legal status of the work, or the authority under which it was built, is shown by the papers referred to.

By the decree of the circuit court in an action for debt against the Elk River Navigation Company, in which the State Bank of West Virginia of Charleston was plaintiff, the property and franchise of the company were sold October 14, 1880. The purchasers were Andrew Brockerhoff, J. D. Cameron, Jacob Tome, Moses Thompson, and John I. Thompson, all of Pennsylvania.

An indictment against the company for obstructing the navigation of Elk River has been pending for several years, but the authorities have, on account of the absence of representatives in this State, never been able, as alleged, to serve process, and nothing at law has ever really been done.

The lock was so miserably constructed that it was out of order and could not be worked a great deal of the time from the first. In September, 1881, navigation having been entirely interrupted by it for some months, a force of men—it is commonly referred to as a "mob"—cut a sluice through the dam. This sluice is now about 70 feet wide, and has cut out down to or below the bed of the river. Canoes, bateaux, rafts and logs, and small steamers, in navigable stages, pass through it. It is still too narrow for certain stages of water, and at least 75 feet more of the old dam should be removed. There is also a high bar just below the dam, formed mainly by material (mostly large stone) from the dam. This should also be removed.

The lock and dam is a complete ruin, and will never be repaired, it is supposed. It appears to be a clear case of abandonment on the part of the owners.

Elk River Boom.—"The Elk River Boom Company," the present owners of the boom located about 3½ miles above the mouth of the river, are the successors of "The Elk River Land Improvement, Manufacturing, and Booming Company," incorporated by act of legislature passed February 27, 1869. Section 3 of the act reads as follows:

> The said corporation are authorized and empowered to erect and maintain on Elk River, at any point or points between its confluence with the Great Kanawha River, at the city of Charleston and village of Sutton, in Braxton County, such boom or booms, with or without piers, as may be necessary for the purpose of stopping and securing logs, masts, spars, and other timber, and to erect such piers and side, branch, or sheer-booms on said river, or any of its tributaries between the points above mentioned, as may be necessary for that purpose; and also to erect and maintain branch or sheer-booms at any point or points on the Elk River as far up said river as the mouth of the Holly, one of the tributaries thereof, and shall have exclusive privileges, provided that said booms be so constructed as to admit the safe passage of rafts and boats, and not prevent the navigation of said river or tributaries.

As the result a suit against the original company, wherein Robert M. Given was complainant, and of another wherein C. D. Copen was complainant, the franchise and property of the company were sold by order of court, and at the November term, 1878, the United States district court approved the sale, and decreed that Mr. William A. Quarrier, as special commissioner, should convey the same to the purchasers, William A. Bradford, of Charleston, W. Va., and others associated with him, under the corporate name of the Elk River Boom Company.

The boom has been and is still considered by a considerable number of citizens of Elk River, lumber-men, etc., an obstruction to navigation, and an indictment was found against the present company in March,

1884. The case was tried here before the circuit [State] court in June last, but the jury failed to agree. It will be tried again soon, probably at the next term of the court.

The boom at present consists of one abutment and thirteen timber and stone cribs, each about 20 by 40 feet in plan and 23 feet high, starting from the left bank and extending up the river about 2,000 feet. The river here at ordinary boating or rafting stages is about 290 feet wide. The opening left for the passage of craft between the right bank and the boom-cribs is, at a 5-foot stage, at the head or narrow part, about 85 feet in width, about 200 feet of the river at this stage being occupied by the cribs and boom.

The principal complaints made against the boom are:

(1) The difficulty of entering or getting over into this passage, the direction of the current being such, it is claimed, caused by a bend in the river above, as to make it difficult in high stages to keep from running into the boom or against the upper crib.

(2) The tendency of the passage to fill up with deposit, sand, etc.

The company has recently done some dredging in and above the passage, but the opponents of the boom claim that this will soon fill up again.

The boom, it will be remembered, is about 1 mile above the old lock and dam. It appears there was little or no complaint about the boom as regards navigation when the pool was full, or before the cutting of the dam. Both of these works, though under the name of different companies, were during construction and for some time afterwards owned, in part at least, by the same men, and were practically under one management. At present, as shown above, the interests and ownership of the lock and dam and of the boom are entirely distinct.

Low grist and saw-mill dams in the upper part of the river.—In my report dated January 21, 1880, and that of Captain Turtle to me of December 16, 1879 (Report of Chief of Engineers for 1880, pages 691, 692, Part I), reference is made to these dams. Captain Ruffner in his report dated June 14, 1881 (Report of Chief of Engineers, 1881, page 917, Part I), also refers to them. Nothing has yet been done towards having them removed.

There are now between Braxton Court-House (Sutton) and the mouth of the river eleven mill-dams. From the best information I can gather, but five of them, viz, Huffman's, Frame's, Birch River, Duck Creek, and Ashley's, are considered anything like serious obstructions, the two first mentioned being by far the worst, and forming really serious impediments to navigation.

The remaining six are either wing-dams, not materially obstructing the channel, or are built so low as not to be troublesome in log or boating stages.

It appears that these dams are built under State charters or by authority granted by the county courts. It is conceded that the courts have no right to grant privileges of this kind that would interfere at all with the navigation of the river. Up to this time there has been very little legal complaint against any of these dams, and, so far as I am informed, no effort worthy of notice has ever been made to get any of them removed or modified to conform to charters.

BRIDGES.

There are two bridges across Elk River at Charleston, one wagon and one railroad bridge. There has never been any complaint made, so far as I am informed, of either of these bridges as interfering with navigation. Both are *lower*, however, than they should be, particularly in view of the probabilities of future navigation and conditions, and it seems proper to refer to them in this report.

Suspension (*wagon*) *Bridge.*—The first above the mouth of the river is the wagon bridge, a wire suspension, built by a company incorporated by act of the assembly of Virginia, passed March 27, 1848. Section 5 of the act requires the bridge to be "so located and constructed as not to injure or impede the navigation of Elk River."

The bridge was finished about 1855. The State of Virginia helped to build the bridge and owned part of the stock, about two-fifths of it. The main cables of the bridge were cut by the forces under General Lightburn when retreating from the valley in September, 1862. By an act of the legislature of West Virginia, passed February 28, 1865, the State relinquished her interest in the bridge to the other stockholders, provided they would rebuild. This was done. It is a toll-bridge, owned by "The Elk River Bridge Company." Mr. Joseph Bibby, of Charleston, is president and controlling member. The bridge is 488 feet long between towers, which stand on the tops of the banks, and over the channel is 38½ feet high in the clear above low water of 1872.

The Ohio Central Railroad Bridge.—This bridge was finished last season, under authority of an act of the legislature of the State, passed February 10, 1882. It is located about one fourth of a mile above the suspension bridge. The act authorizing its construction required the channel-span to be not less than 200 feet in the clear, and all the spans to be at least as high above the surface of the water as the suspension bridge. It is an iron Pratt truss bridge, of three spans—a center span of 209 feet (200 feet at low water), with shore spans of 100 feet each. At present the low-water width of the channel-span is contracted by the embankments of the coffer-dams, which have not been removed. The clearance under the whole bridge is 40.40 feet with reference to low water of 1872.

The steam-boat navigation of Elk River is at present of no great importance; ordinarily one small packet makes daily trips to the mouth of Big Sandy, 21 miles up. There is water enough, on an average, for this trip about two hundred and fifty days in the year. Out of this may be taken from four to six weeks' interruption by ice. These small boats can pass under the bridges, with stacks down, up to about 18 feet by Charleston gauge. The record shows the water to be at and above this about eight days in a year.

The main difficulty is in the fact that larger boats, the smaller sized Kanawha tow and freight boats, are unable, except in low stages, to go under the bridges at all, and it is often desirable to reach the numerous mills, etc., located between and above the bridges. This inconvenience will be more felt as the lumbering interests of Elk are developed and the mills and factories increase. The bridges over Elk near Charleston should be at least 48 feet in the clear above low water. This would enable the smaller size Kanawha boats to pass under up to about a 16-foot stage, or at all times except about twelve days in the year. Such a requirement, as shown, would compel the raising of the railroad bridge about 8 feet and the suspension bridge 9½ feet. It is probable that the river interests will before many years demand at least this height.

In conclusion, the following suggestions are respectfully submitted: It appears that up to this time the State has assumed entire control of these works on Elk River, and that all efforts thus far made to get any of them removed or modified have been with the State. Considering this, the nature of the present navigation and the limited character of the improvement thus far attempted by the United States, it does not appear necessary or advisable, at present at least, for the General Government to take control of the river or to interfere with the regulation of structures as reported on herein, either in or across it.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN JAMES C. POST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, Ohio, February 3, 1885.

GENERAL: In compliance with General Orders, No. 13, Headquarters Corps of Engineers, dated Washington, D. C., July 23, 1884, I have the honor to submit the following report giving the information required in section 2 of the river and harbor act of July 5, 1884, so far as relates to the rivers in the district under my charge:

The section referred to is as follows:

> SECTION 2. That the Secretary of War shall * * * report whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation, and, if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstruction.
>
> * * * * * * *

As regards the information desired in this paragraph, I have to state that the navigation of but four of the rivers of which I have charge is restricted or in any way affected by bridges, dams, or other structures. These are the Kentucky River, Kentucky; the Little Kanawha and Guyandotte rivers, West Virginia; and Big Sandy River, Kentucky and West Virginia.

KENTUCKY RIVER.

This river has been improved by slackwater navigation from its mouth to 17 miles above Frankfort, a distance of 82 miles, by the construction of locks and dams, and it is proposed to extend this improvement an additional distance of 170 miles. At present there are eight bridges crossing the river. They are as follows:

Where located.	Distance from mouth of river.	Object of structure.	Number of spans.	Length of channel-span.	Height of bridge above low water.	Remarks.
	Miles.			*Feet.*	*Feet.*	
Worthville	8	For Louisville and Nashville Railroad.	5	201⅛	52⅝	Iron; three through and two deck.
Frankfort, foot of Broadway.	65.25	do	3	162⅛	38⅛	Iron; one through and two deck.
Frankfort, foot of Saint Clair street.	65.75	For county	4	111⅝	36⅛	Wooden; through bridge.
Brooklyn	112.75	For turnpike	3	175	68	Iron; through bridge.
High bridge	116.65	For Cincinnati Southern Railroad	3	342	285	Iron; deck bridge.
Hickman	135.2	For turnpike	1	240	70	Wooden; through bridge.
Cleveland	170.3	do	2	216⅛	65	Irun; through bridge.
Boone's Ford	177.1	For Kentucky Central Railroad.	2	305	80	Do.

But three of these bridges, those first named, restrict navigation.

The commerce of the river is carried upon a number of steamers, which make frequent trips. The largest of these measures 34 feet from the surface of the water to the top of the pilot-house. As this steamer is as large as the locks now in operation will accommodate, its height may be taken as regulating the amount of headway that will be required for free and safe navigation.

The bridge at Worthville is 52.67 feet above the level of Pool No. 1. Assuming that 35 feet is required under the bridge, 34 for the height of the steamers, with 1-foot clearance, a rise of 17.67 feet stops navigation. To give unrestricted navigation, according to the records of the height of the water in 1884, would require that this bridge be raised 28.26 feet, as the water stood at a height of 41.93 feet above normal pool level. This, however, is regarded as excessive, as it is based upon the unusual flood last year in the Ohio River, which backed the water up in the Kentucky. If this bridge was raised 10 feet, which would make its height 62.67 feet above pool level, and permit a rise of 27.67 feet in the river before navigation was interfered with, it would be considered sufficient for all the necessities of commerce. Navigation could then be continued to Frankfort, the principal point upon the river, during all ordinary stages of high water, and if it should be suspended by the water rising higher, the delay would probably amount to only a few days, and most seriously affect commerce. I know of no serious difficulty in the way of the railroad company raising this bridge as proposed. The width of the channel-span of this bridge is sufficient for the accommodation of navigation.

The two bridges at Frankfort, respectively 36.33 feet and 38.33 feet above pool level, greatly restrict the passage of steamers desiring to proceed above Frankfort. The following table gives the number of days during each month of 1884 that they obstructed navigation, taking, as before, 35 feet as the headway required. From this it will be seen that a rise of 1.33 feet and 3.33 feet above pool level will prevent the passage of steamers under them.

Number of days during each month of 1884 *that the water was more than* 1.33 *feet,* 3.33 *feet, and* 11.33 *feet above level of Pool No.* 4, *Kentucky River.*

Months.	Above 1.33 feet.	Above 3.33 feet.	Above 11.33 feet.
January	28	20	
February	29	24	17
March	31	26	6
April	27	7	
May	19		
June	1		
July			
August			
September			
October			
November			
December	5		
Total	140	77	23

It will be seen from this that the railroad bridge prevented navigation 77 days, or 21 per cent. of the year, and the Saint Clair Street Bridge 140 days, or 38 per cent.

The Saint Clair Street Bridge was built under a charter granted by the legislature of the State of Kentucky, approved January 25, 1810, and is owned jointly by Franklin County and the city of Frankfort. It is the only direct means of communication between Frankfort and South Frankfort. The bridge is not only too low, but by being divided into four short spans greatly obstructs navigation. The piers, especially the one in the channel, which is next to the Frankfort shore, catch quantities of drift during the season of high water, which usually closes the water-way under at least two of the spans. Lately a proposition has been considered for removing this bridge and replacing it with an iron one to be composed of two nearly equal spans, the shorter one being 206 feet in length, and whose height will be 46.33 feet above the pool level, or 10 feet higher than the present bridge. This height will permit steamers to pass under the bridge during all stages of water up to 11.33 feet above normal pool level. By referring to the last table it will be seen that the water was above this height but twenty-three days during the year 1884. Without additional data, it is impossible to state definitely whether the height of the water during last year would represent those of an average year, but it is believed that they are sufficient to enable a fair approximation to be made of the amount of obstruction that a bridge of the proposed height would be to navigation. The approaches to the bridge are now nearly level, and it is part of the plan to obtain the increased height by raising the streets and establishing a grade to the bridge. This, however, can not be done so as to obtain still greater height without probable damages to the property along the approaches, or making too steep a grade, and therefore an additional height has not been considered. It is also regarded inadvisable to recommend that a draw be placed in the bridge, as it would then be an obstruction to both navigation and to the travel, which is almost constant between the two parts of the city, besides being a source of danger to both. Considering these facts, and the few days in each year that a bridge constructed 46.33 feet above low water would interrupt navigation as indicated by the record of 1884, and that with but one pier there would not be likely to be sufficient accumulation of drift to obstruct the channel, I believe that a bridge constructed according to the plan proposed would satisfy all reasonable demands of commerce. I therefore recommend that the bridge be rebuilt with these modifications. Beyond discussing it generally, so far as I can learn nothing has yet been done towards rebuilding this bridge, and it may be necessary for Congress to take some action before it will be done. It has been suggested to me that the United States should bear part of its cost, but I know of no claims upon which this can be justly urged. The present bridge is very old, and the piers are greatly out of repair, and it will not be many years before a new bridge becomes a public necessity.

* * * * * * *

A drawing* of the present bridge and of the new one with the modifications recommended accompanies this report.

The height determined for the new Saint Clair Street Bridge also determines the height to which the Louisville and Nashville Railroad Bridge at Frankfort should be raised, as these bridges, to give equal freedom to commerce, should be of the same height. The railroad Bridge is at present 2 feet higher than the Saint Clair Street Bridge, and therefore it should be raised 8 feet. It is believed that this can be done without any unusual difficulty. The length of the channel-span in this bridge, which is at present 162 feet, should be increased to at least 200 feet, which is the minimum width that will fully accommodate the commerce of this portion of the river.

---

*Drawing omitted.

LITTLE KANAWHA RIVER.

The only bridge crossing the Little Kanawha River is at Parkersburgh, about 1,100 feet from its mouth. This bridge belongs to Wood County, W. Va. It has one clear span of 293 feet in length between the abutments, and is 42.8 feet above the water when it is at zero on the gauge. With the water at an 18-foot stage it prevents the larger boats of the Little Kanawha River from passing into the Ohio River. The water is at this height, or about it, as near as I could ascertain, about eighty days during each year, or nearly 22 per cent. of the time.

The mouth of this river is also used as an ice-harbor for the Ohio River boats. It is regarded as a safe harbor, and is used for this purpose whenever there is running ice. I am informed that as many as eleven steamers have put into this harbor at one time for protection. A thorough discussion of the Little Kanawha River as an ice-harbor is contained in the Report of the Chief of Engineers for 1880, page 1790, and was submitted by Maj. W. E. Merrill, Corps of Engineers. The conclusion he came to, after fully considering the conditions, was that because of the limited extent of the river available for this purpose, it being cut off from the portion above, except for smaller boats, by the bridge mentioned, that it would be better to form an artificial ice-harbor in the Ohio River near this point. This plan, however, even if carried out, would be of little or no benefit to the navigation of the Little Kanawha. If the bridge were removed, which could only be effected by the United States buying it and taking it down, the portion of the Little Kanawha available as an ice-harbor for all steamers would then become from 2 to 3 miles in length, and navigation would be unrestricted. It may be well to observe here that both above and below the bridge the river is 100 feet wider than the distance between the abutments. If the bridge is to be preserved, there are but two methods remaining by which navigation may be aided—first, by raising the bridge, and second, by converting it into a draw bridge. As it is considered impracticable to raise it sufficiently, it is deemed best to recommend that it be made into a draw-bridge, by building a middle pier. A drawing* is forwarded with this report showing the bridge as it is at present and with the proposed modification. It will be observed that there will be a width of 128.5 feet between the turn-pier and the abutment. This change will materially aid navigation in the higher stages of water, and will also give the mouth of the river greater value as an ice-harbor.

It is proposed by the Ohio River Railroad, I have been informed, to build a bridge across the Little Kanawha River at its junction with the Ohio River, this bridge to be given an elevation of 60 feet above low water. A bridge of this height will effectually prohibit the use of the portion of the Little Kanawha now available as an ice-harbor by all the larger Ohio River boats seeking refuge from the ice. From the accounts I have received from this locality during the present winter its great usefulness in preserving valuable property from destruction has been clearly proven, and I regard it as highly important to commerce that it should be preserved. I therefore recommend that if a bridge is built at this point it be required to conform with the laws regulating the construction of bridges across this portion of the Ohio River.

If the railroad company desires to construct a lower bridge, a location might be selected above the county bridge. A bridge crossing this part the Government to expense for dredging to improve the situation, and prevents any rectification of the bend, which, of itself, is a serious but remediable obstruction.

---

* Drawing omitted.

Remedy proposed.—The bridge should be removed, its location changed. If it could be moved only 200 feet down-stream, the situation would be greatly improved. If allowed to remain at its present location, which is not recommended, the draw should at once be made to open entirely out of the way of boats, the left bank of the river near the draw be bulkheaded or revetted even with the face of the abutment, as a guide to descending boats, for a distance of at least 75 feet above the upper end of the draw when open to 30 feet below the bridge abutment.

(5) *Float-bridge across the Fox River at Port Hope*, belongs to the town of Fort Winnebago. It needs only guard-pile protections on each side of the opening, above and below, as guides.

(6) *Float-bridge at Packwaukee, Wisconsin*, belongs to the the town of Packwaukee. This bridge has a clear opening for navigation of but 47 feet, and its location on Lake Buffalo is greatly exposed to winds.

Remedy proposed.—The method of holding the floating draw should be changed to allow the draw portion to swing in behind the causeway, instead of projecting into the opening, and the approaches on each side of the opening above and below should be well protected by guard-piles, to guide boats and prevent their being blown against the ends of the causeway.

(7) *The highway bridge at Princeton, Wisconsin*, belongs to the town of Princeton. The left opening only is available for navigation. The clear opening is only 47½ feet, at right angles to the current. The bridge is dangerous.

Remedy proposed.—The clear opening should be enlarged to 60 feet, at right angles to the channel, and the left opening be protected with spring-piles, to prevent boats striking the stone piers, especially in windy weather.

(8) *The bridge at Berlin, Wisconsin*, belongs to the city of Berlin. The right opening is not passable by boats on account of shoal water and bowlders. A direct approach to the left opening from above is prevented by a projecting log-boom. The obstruction to navigation results from this boom.

Remedy proposed.—The log-boom should be removed or narrowed to one-half its present width. The laws of the State of Wisconsin cover the case (Revised Statutes, Wisconsin, section 1598, page 478).

(9) *Highway Bridge across Fox River at Omro, Wisconsin*, belongs to the town of Omro. The open draw overhangs the center pier, and the projecting sidewalks obstruct navigation and endanger boats passing the bridge.

Remedy proposed.—The projecting sidewalks, or one of them, should be removed or else spring pile protections and guides be placed to assist boats to pass safely.

(10) *Bridge at Algoma street, Oshkosh, Wisconsin*, belongs to the city of Oshkosh. The sidewalks of this bridge overhang the pier and endanger boats by projecting into the channel-way.

Remedy proposed.—Remove the projecting sidewalks, or provide suitable guides and protection piles or piers.

(11) *The Chicago, Milwaukee and Saint Paul Railroad Bridge at Oshkosh* has but a single draw-span, of 60 feet, which is insufficient to accommodate the steam-boats and sailing vessels. Another opening is needed.

(12) *Highway Bridge at Light street, Oshkosh, Wisconsin*, is owned by the city. The draw, when open, overhangs the piers and projects into

the channel, endangering boats passing through the opening. Proper guards are needed, or the projections should be removed.

(13) *Highway Bridge at Main street, Oshkosh, Wisconsin.*—The draw, when open, overhangs the pier. Same remedy proposed as for similar cases above mentioned.

(14) *The Chicago and Northwestern Railroad Bridge at Oshkosh, Wisconsin,* belongs to the Chicago and Northwestern Railroad Company. This bridge has a double opening, but only one of them can be used, the other being closed by a platform and track for the draw. The one in use is only 56 feet wide, and is placed too near the right bank. Complaints are made by steam-boat men of its location. It is difficult of access, and more so because alongshore is taken up by rafts for quite a distance out.

Remedy proposed.—There is abundant room for both rafts and channel. The rafts do not project out an unreasonable distance, so that the railroad company should be the party to accommodate navigation. A double draw, of 60 feet span each, is required about the middle of the river. The tracing* herewith gives the location of the five Oshkosh bridges.

(15) *The Chicago and Northwestern Railroad Bridge over the Neenah Outlet to Lake Winnebago* is a pile bridge, and is without a draw. This bridge has entirely destroyed the navigation to the town of Neenah, and to and from the mills located there. The company has paid no attention to the repeated demands of the citizens of Appleton and Neenah and the boatmen for a navigable pass or draw through this bridge. The bridge is not over the through channel of navigation, but is over part of the navigable waters of the United States, and deprives the citizens of the use of facilities for water transportation they would otherwise have.

Recommendations.—It is recommended that the railroad company be compelled to put a draw in this bridge, and remove any obstructions to navigation they may have placed in the former channel of this part of the Fox River.

(16, 17, 18) The following bridges *over the Menasha Canal* have insufficient draw-spans, which should be widened to 60 feet: Upper Highway bridge, draw 49.5 feet wide; Lower Highway bridge, draw 49.9 feet wide; Milwaukee and Northern Railroad bridge, draw 50 feet wide.

(19) *Milwaukee and Northern Railroad Bridge just above the Appleton upper dam* is a serious obstruction to navigation. The piers are all oblique to the current, and dams it back so as to cause a rapid current through the draws and piers, which at high water is much increased by the "draw" over the dam just below it. Owing to complaints by boatmen, the company heretofore agreed to extend the pier next to the north channel 75 to 100 feet up stream, to control the oblique current, and to assist in cutting off the point at the right bank of the river, to facilitate access to the right or south draw. The company failed to make these changes. The location is a very bad one, and the construction is objectionable throughout.

Recommendations.—It is recommended that the company be required to enlarge the water-way through its narrow spans on the left of the draw, to lessen the damming up effect of the bridge, and to extend the center or draw pier at least 150 feet up-stream, to cut off the oblique current across the head of this pier, and to serve as a guide for boats passing the right draw-opening.

---

* Tracing omitted.

(20) *The highway bridge across the upper canal at Appleton*, owned by the city of Appleton, is dilapidated, and has an opening of only 47½ feet in width. When rebuilt it should have a draw 60 feet wide.

(21) *The bridge of the Milwaukee, Lake Shore, and Western Railroad immediately below the Appleton third lock* crosses the channel obliquely, and the draw is difficult of access to boats coming out of the lock. The span of the draw-bridge is 80 feet, while the clear opening perpendicular to the channel axis is only 49.8 feet.

Recommendations.—The new lock at this point will cause the left opening to be the one used by boats. This should be increased in width of span to at least 60 feet perpendicular to the channel axis. The changes should be required made only when the location of the new lock is definitely fixed, to avoid inflicting unnecessary expense upon the railroad company.

The Wisconsin Central Railroad has removed its bridge from across the Menasha Canal, but left the piers standing in the channel as dangerous obstructions. This company should be compelled to remove these piers to a depth of 8 feet below extreme low water in the canal.

(8*a*) *Highway bridge across Upper Fox River, about one mile below the city of Berlin*, belongs jointly to the city of Berlin and the town of Aurora, Waushara County, Wis. This bridge is located just below a bend in the river, and at a point where the channel crosses from the left to the right bank. The current is oblique to the open draw. The bridge is especially dangerous at high water, when the current is considerable, at which time it is nearly impracticable for boats to pass down-stream without striking the piers or draw.

Remedy proposed.—The location of the bridge should be changed so that the piers of the opening shall be parallel with the current or channel. The draw-span should be at least 60 feet clear opening when measured perpendicular to the axis of the channel, and the opening should be protected by guide-piles, to assist boats in passing the draw at high water.

This report is accompanied by tracings* of the bridges mentioned, numbered as in the report.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR THOMAS H. HANDBURY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., January 6, 1885.

GENERAL: To comply with the instructions contained in General Orders No. 13, dated headquarters Corps of Engineers, Washington, D. C., July 23, 1884, I have the honor to report as follows concerning the bridges, causeways, or structures now erected or in process of erection that do or will interfere with the free navigation of the rivers now temporarily in my charge. It is proper for me to state at this point that the data for this report were collected under the direction of Maj. W. H. H. Benyaurd, Corps of Engineers, who is in permanent charge of the improvement of these rivers, but at this time absent on account of ill health.

---

* Tracings omitted.

CALUMET RIVER, ILLINOIS.

This river empties into Lake Michigan near its southern extremity and about 12 miles south of the mouth of the Chicago River. From its mouth to the outlet of Calumet Lake, a distance of 6½ miles, it is crossed by four wagon-road and five railroad bridges, all of which are, in its present state, more or less of obstructions to the commerce of the river. At the mouth of the river the United States has already constructed works to facilitate entrance to it. It is further contemplated, under existing authority from Congress, as soon as certain rights of way can be secured, to enter upon the execution of a project for the improvement of the navigation of the river over the distance mentioned, which will necessitate radical changes in its course at certain localities and in its character throughout. This project is outlined in a report, under date of October 6, 1882, of a Board of Engineer Officers constituted in compliance with certain requirements of the river and harbor act of August 2, 1882. The report is published in Senate Ex. Doc. No. 9, Forty-seventh Congress, second session.

The suggestions which follow in regard to the changes necessary in these bridges, in order that they may cause the least practicable inconvenience to the commerce of the river without material detriment to the commerce over them, have reference to the condition of the river when the project for its improvement above referred to has been fully carried out.

It is evident, from the rapid increase in the amount of capital being invested in this vicinity, that the commerce of this river will at no very distant day tax its entire capacity. The necessary obstructions to its free navigation should therefore be reduced to a minimum.

The minimum width of channel, as fixed by the project, is assumed at 200 feet. Considering the character and importance of the commerce it could very justly demand a clear opening of at least 60 feet on each side of the draw-pier of all bridges placed over the river.

Accompanying this report are eleven tracings,* one being from a map showing the general course of Calumet River, the remaining ten being drawings showing bridges, etc., over the same.

Commencing at the mouth of the river and going up, the first bridge met is at Ninety-second street, South Chicago. (See Plate II.) This is an iron-truss wagon-road bridge, with sidewalks on both sides for foot-passengers. It was built in 1883, and is now a good, substantial structure. There are two draw-openings, each about 73 feet wide in the clear. One of these only is at present available. On the completion of the projected improvement of the river both openings can be used. The approaches to the openings will be reasonably fair. It is not thought that any change will be necessary in this structure.

Bridge No. 2 (Plate III) is at Ninety-fifth street. It is a wagon-road wooden bridge, with a draw-opening of about 53 feet in the clear. The arrangements for opening and closing this bridge are of a very primitive character; one end of the movable part rests upon a pontoon, or scow, while the other rests upon piles upon which a pivot is arranged around which this part is made to turn. A cluster of piles is driven near each of the two shores. To one of these one end of a chain is made fast; it then passes over a windlass situated upon the pontoon, and from thence to the other cluster of piles. The bridge is maneuvered by turning the windlass. Arrangements are made on the ponton for adjusting the level of the bridge to correspond to the height of the water in the river. This bridge was built in 1875, as a temporary expedient for crossing the river at this point. Its serviceable period is about at an end. The necessities of its own traffic will soon require that it be replaced by another and more commodious and permanent structure.

---

*Tracings omitted.

So far as the necessities of navigation are concerned, it is thought that a structure such as the one now at Ninety-second street would fulfill all the essential conditions at this point.

At the next point at which we find the navigation of the river obstructed there are three railroad bridges, in immediate proximity to each other. Nos. 3, 4, and 5 (Plates IV, V, VI), belonging, respectively, to the Baltimore and Ohio, Lake Shore and Michigan Southern, and Pittsburgh and Fort Wayne railways. These are all substantial iron pivot-draw bridges. They are so arranged as to give but one opening to navigation, of a width of only 60 feet. In neither case is the pivot at the center of the bridge. Their location is such that but one (the Baltimore and Ohio) can be maneuvered independently.

Experience has proven that the present arrangement of these bridges is very much to the detriment of the commerce of the river, causing to it vexatious and expensive delays. With but one opening of 60 feet, it is impracticable for vessels to pass each other at these bridges. The larger class of lake vessels would find great difficulty, under any consideration, in passing them. If such is the case now, the difficulty will be greatly increased as the commerce of the river increases, and long before it assumes the proportions of the present commerce of the Chicago River these bridges would amount to almost an absolute obstruction to navigation. A radical change in this locality will therefore be necessary.

The most reasonable demand that the commerce of the river could make would be that two openings be provided in this locality, neither to be less than 60 feet in the clear.

Two methods are suggested (Plate VII), by either of which the desired change could be effected. The first contemplates that the two outside tracks be made to approach the middle one in the vicinity of the river, and that they all cross on one large bridge, which would provide for the requisite openings on the two sides of the pivot-pier. In the second, the distance between each of the two outside tracks and the center, in the vicinity of the river, is to be increased, and each to cross on its own bridge. The pivot-piers of these bridges are located on the same straight line, at such distances apart that each bridge can be maneuvered independently of the others. The requisite channel-way for vessels is to be provided on each side of the line of piers. Should either of these plans be adopted, it would necessitate a slight change in the directions of the dock-lines in this vicinity from those recommended by the Board of Engineers.

The details of these alterations have not been entered into, as it is assumed that for all the purposes of this report it will be sufficient to indicate what is necessary in order that the just demands of the commerce of the river may be met, and in a general way to point out how this may be done, leaving it to those whose province it is to meet these demands at the proper time to prepare the detailed plans for so doing, subject to the approval of the honorable the Secretary of War.

Since the date of the report of the Board of Engineers, October 6, 1882, a dock line has been built in the vicinity of these bridges by the Calumet and Chicago Canal and Lock Company, which is within the lines recommended by the Board. (See Plate VII, Figure 2.) Whether this will be an obstruction to navigation or not will depend upon the modifications made in the proposed dock lines when the necessary alterations are made in the bridges.

Passing on up the river, the next bridge, No. 6 (Plate VIII), is at One hundred and sixth street, and the next, No. 7 (Plate IX), is at Chittenden. These are both wooden wagon-road bridges, of precisely the same construction as Bridge No. 2, at Ninety-fifth street, heretofore described. The remarks made in that connection as to changes necessary apply with equal force to these two localities.

Bridge No. 8 (Plate X) is an iron pivot-pier railroad bridge, built by the Western Indiana Railway Company. It provides for two channels for vessels, although but one is at present available. In the clear, these openings are only about 42 feet, much too small for even the present need of the commerce of the river.

The most speedy and economical method of remedying the defects of this bridge would seem to be to replace it by one of longer spans, giving the necessary opening on the two sides of the pivot-pier. It is possible that this pier may be found sufficient for the new structure. The abutment piers will have to be removed and placed further inshore.

Bridge No. 9 (Plate XI) is the last one on that part of this river on which improvement has been authorized by act of Congress. It is an iron girder railroad bridge, built by the New York, Chicago and Saint Louis Railroad Company. It provides for two channel-ways for vessels, only one of which is at present available. The openings are about 52 feet in the clear. To increase these to 60 feet or more it will be necessary to set the abutments further inshore and increase the length of the bridge accordingly. The present pivot-pier is doubtless sufficient for the new structure.

* * * * * * *

Very respectfully, your obedient servant,

THOS. H. HANDBURY,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN D. W. LOCKWOOD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Grand Rapids, Mich., August 23, 1884.

SIR: In compliance with instructions contained in General Orders No. 13, dated Headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following report with reference to the railway bridge across the Saint Joseph River near the town of Saint Joseph, Mich.:

The bridge is a pile structure, with two draws of the "jack-knife" pattern, each 60 feet wide in the clear, and distant from each other 280 feet. The south draw has its south abutment about 88 feet distant from the dock line, which is irregular in direction and makes quite a large re-entering at the point where the bridge leaves the shore. Only the south draw is practically of any account at present, as the depth of water in the north draw is only about 3 or 4 feet, and, up to the 12th instant, it had only been opened once during the present year. The distance from the end of the north pier to the south draw is about 2,200 feet; from the end of the south pier this distance is 1,500 feet.

In storms from the northwest around to southwest the harbor entrance is much exposed and a heavy sea makes in the channel up to the draw, rendering it difficult for a vessel under sail to make the present narrow opening.

The Board of Engineers that reported on this subject, in June, 1875, recommended substituting for the present south draw a pivot-draw, with clear openings on each side of the pivot of 75 feet. In my report of March 27, 1884, I stated as follows:

> In conclusion, I would state that I can see no way of restoring the harbor to its full capacity of usefulness, or place it in such condition that improvements commensurate with its importance as a harbor of refuge can be safely projected and carried out, except by removing the present bridge entirely.

This was practically the opinion given by the late Major Harwood in his report under date of February 23, 1882, to wit:

> And consider the removal of the bridge and piers to the extent of at least 300 feet from the Saint Joseph Dock line a necessity to the proper preservation of the harbor, etc.

Further examination has convinced me that so complete a change is hardly necessary; and I would now present the following plan for modification of the bridge, which, in connection with a change in the dock line, will, I think, do much towards affording a comparatively easy passage of the obstruction which the bridge now constitutes.

(1) To replace the present south draw with a pivot-draw, having clear openings on each side of the pivot of 100 feet. The south abutment to remain as at present. The draw would in this case take up 225 feet, 25 feet being allowed for the pivot.

(2) The dock line to be changed as represented by full red line on tracing* herewith.

The present draw is defective in several particulars. In the first place, it is too narrow, being only 65 feet wide, for a vessel under sail in bad weather to make the opening with certainty; and, in the second place, it is located too far from the dock line as this now stands. Should a vessel entering strike the down-stream starling at present, she would in all probability run into the bridge between the south abutment of the draw and the shore, while the remedy for this defect, with the present narrow draw, by advancing the dock line would be at the expense of dock-room below the bridge, and a vessel lying at the wharf anywhere near the draw would practically close it by reducing the opening. With a pivot-draw (two openings, each 100 feet wide) a vessel entering or leaving the harbor would have the choice of taking either passage, but as the worst storms here are usually from the northwest, the south opening would be the one generally used by vessels entering, and on this account I would have the down-stream starling make a greater angle with the bridge on the south side than the present one does, in order to make the passage going in as easy as possible.

The proposed modification of the bridge, together with the change in dock line recommended in connection therewith, are shown on the tracings* herewith.

Should the bridge be modified as before explained and the south dock line advanced, then the needed improvements at this harbor could be carried to completion. The present plan of work under the appropriation of July 5, 1884, is to rebuild the north pier, from the angle "A" to the point marked "B," on a line parallel to the south pier. The part to be rebuilt is in a tumble-down condition, and can not be expected to stand much longer. From the point "B" a line of revetment could then be built parallel to the new south dock line, and the north side of this new channel having been dredged out, there would then exist a condition of affairs that would give to the harbor something like its former value and importance as a harbor of refuge.

---

*Tracings omitted.

The regular dock for steamers at Saint Joseph is just below the railway bridge, and any radical changes that might be made in the approach to the draw to facilitate its passage going in would materially encroach upon the present wharf privileges. The most that I would recommend, therefore, in the way of construction for the guiding of water craft through the draw at present, would be the putting in of two or more clusters of fender-piles on the south down-stream side of the draw, or a fender-pier extending 30 feet down-stream, making an angle of about 70 degrees with the line of the bridge.

Very respectfully, your obedient servant,

D. W. LOCKWOOD,
Captain of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., December 15, 1884.

SIR: I have the honor to submit the following report in accordance with the provisions of section 2 of the river and harbor act of July 5, 1884:

* * * * * * *

The appended report by Mr. B. H. Muehle, assistant engineer, * * * covers the cases where "bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation," and suggests the best mode of controlling such obstructions as now exist and preventing future constructions which may be in the nature of obstructions.

I find myself quite unable to suggest the form of legislation that may be desirable to accomplish the desired object, and the difficulty is greatly magnified by the fact that the business transacted upon this comparatively narrow stream is so great as to render almost impracticable any remedial measures which shall not carry with them considerable hardship in individual cases. However, I concur in Mr. Muehle's suggestion that whatever legislation is attempted should look to the establishment of dock and boom lines by the United States authorities (probably in conjuction with the State or local authorities), which should afterwards govern all concerned, with sufficient penalties for infractions of the law.

Very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. A. S.

ress of the harbor improvement, and this depends upon the amounts of money appropriated by Congress. Therefore no time can be definitely set for a future necessity for increased width of draw.

No other bridges situated with the limits of the operations of this office are known to be obstructions to free navigation of the waters which they span.

* * * * * * *

Very respectfully, your obedient servant,

G. H. MENDELL,
Lieut. Col., Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR W. A. JONES, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, February 7, 1885.

SIR: I have the honor to submit report called for in Special Orders No. 13, Headquarters Corps of Engineers, 1884, concerning the district under my charge.

It is made up from information obtained by Captain Powell, before my arrival here; from a hasty examination of the Snake River Bridge, on the Northern Pacific Railroad at Ainsworth, Washington Territory, and the bridges over the Yamhill River, since the receipt of telegram of the 31st ultimo, calling for a report immediately.

UPPER WILLAMETTE RIVER.

Capt. E. C. Gove, of the snag-boat *Corvallis* reports that obstructions exist on the river as follows:

At Springfield, 6 miles above Eugene, a bridge (draw).
At Eugene, a county-road bridge (draw).
Two miles below Eugene, a wire ferry-cable.
At Harrisburgh, a railroad bridge.
At Harrisburgh, a wire ferry-cable.
At Alford's Chute, a rope ferry-cable.
At Centennial Chute, a rope ferry-cable.
At mouth East Channel, a rope ferry-cable.
Three miles above Corvallis, a wire ferry-cable.
At Albany, a wire ferry-cable.
At Buena Vista, a wire ferry-cable.
At Leobolis Ferry, a rope ferry-cable.

The wire ferry-cables mentioned above are placed on high poles, one on each side of the river, and during low stages of water are left quite slack, which causes them to fall very low in the center. At high stages of the river they are hauled out taut, which raises them in the center; but at very high stages of river they will then be liable to catch the smoke-stacks or pilot-houses of passing steam-boats. In such cases the steam-boat must either cut the cable or wait until the owners come and lower it. Again, when the river is low and the cables are slack, any sudden rise in the river, and for which the owners would be unprepared, would place steam-boats in danger of them.

With regard to the rope ferry-cables, they are low down, and when steam-boats approach "the whistle is blown for the owners (who are never near, as every one crossing on them ferry themselves over), and if they do not come, they either have to send a man ashore to let go the cable or run through it."

Concerning the railroad bridge at Harrisburgh, it is a draw-bridge, with draw-spans of 125 feet each. The piers are cribs filled with stone.

The approaches to the draw are pile trestles, with bents 16 feet open. Whole length of bridge, including trestle-work, 950 feet. Height of floor-timbers above high water, 2 feet.

E. W. Spencer, master and owner of the steam-boat *Salem*, says of this bridge:

> The last time I passed through the draw was in the spring of 1877.
>
> Captain James Miller made a few trips in the winter of 1878. I am sure no boats have passed through the draw since.
>
> We passed through the South Span ascending and descending. The passage was never safe, and is now choked by a sand or gravel bar, formed three years ago.
>
> The deep water is now under the bridge, near the north bank of the river.
>
> I examined the draw last fall, and considered it such an obstruction that I would not attempt the passage with my boat.
>
> The east span of the draw has never been safe, on account of a strong current sweeping across the stream from the east side; so we never ventured on that side.
>
> The chimney of the *Salem* is 41 feet above water-mark when light.
>
> A new draw must be put in across the present deep channel. The sooner the better, as freight charges are from Eugene City to Portland double those from Harrisburgh, and the railroad is the cause of it.

COWLITZ RIVER.

There is one railroad bridge and two wire-rope ferries over the navigable portion of this river.

The bridge belongs to the Northern Pacific Railroad. It is a Howe truss, with two spans of 200 feet length. Whole length of bridge, 450 feet. It is carried by crib abutments and one crib-pier. The bottom of the girders is 45½ feet above low-water mark, and 17½ feet above the high-water mark of 1876.

Mr. R. A. Habersham, assistant engineer, states:

> As to the best way of removing the obstructions reported, I approve Captain Spencer's plan. At the Harrisburgh Bridge, viz: Building a new draw over the deep channel, and the railroad company should be required, if possible, to maintain the channel in its present place by means of training-dikes and bank-revetments.

UPPER COLUMBIA RIVER.

No obstructions are reported.

SNAKE RIVER.

There is a railroad draw-bridge, of the Northern Pacific Railroad, over this river at Ainsworth, Wash., and also eight wire ferry-cables between Ainsworth and Lewiston.

Steam-boatmen report that these ferries form no obstruction to navigation.

The railroad bridge at Ainsworth is 1,574 feet long and consists of eight iron-truss spans, resting in granite piers and abutments. Six spans are fixed, and two are covered by the draw-bridge. The clear distance between the draw-spans at low water is 152 feet.

I do not consider the bridge an obstruction to navigation.

CLEARWATER RIVER.

There are three wire-rope ferries within 7 miles of the mouth of the river, at Lewiston.

At present they form no obstruction to navigation.

YAMHILL RIVER.

I submit report of Mr. Richard M. Tabor, assistant engineer:

PORTLAND, OREGON, *February* 6, 1885.

SIR: In accordance with your instructions, I proceeded to the Yamhill River, on the Oregon Railway and Navigation Company's steamer *Orient*, on the 4th instant, to examine bridges. The cantilever bridge over that river at Dayton is 40 feet 4 inches clear span, and 41 feet above low water to springing of cantilevers. When they are open a space of 16 feet is obtained for passage of steamers' smoke-stacks. The *Orient* passed through, up and down, without much trouble, although there was a width of only 3 feet to spare for her guards to clear.

The Narrow-gauge Railroad Bridge, 3 miles above Dayton, is a fixed truss bridge, 130 feet wide and 80 feet high above low water. Six hundred yards above this railroad bridge is the county-road bridge, which is a truss bridge, 59 feet 6 inches above low water, and 120 feet wide. The *Orient* could not pass under it at that stage of water, her smoke-stack being 18 inches too high, and she dropped back until a lower stage of water, which was then 15 feet above low-water level. The *Orient* is 150 feet long over all, 37 feet 4 inches across her guards, and the top of her smoke-stack is 46 feet 3 inches above the water. She draws 3 feet when full laden to 250 tons. This is the only boat that has run up the Yamhill for three or four years. None have run up as far as La Fayette for the past four years, until this winter, when the *Orient* made two trips to that point. No boat has run above La Fayette for the last six years, although small steamers can get up as far as McMinnville with a good stage of water. This does not cause any complaint, as the freight is now all carried by rail since the opening of the narrow-gauge. A single telegraph-wire crosses the Yamhill just below the Narrow-gauge Railroad Bridge at La Fayette, at height of 64 feet above low water.

The Yamhill River rises at times 39 feet above low water, and falls and rises very rapidly.

I have the honor to be, sir, your obedient servant,

RICHARD M. TABOR,
Assistant Engineer.

Maj. W. A. JONES,
Corps of Engineers, U. S. A.

The bridges over the Willamette, the Yamhill, and the Cowlitz are obstructions to navigation, but in the short time at my disposal I am not prepared to suggest methods of altering or constructing said bridges.

The wire-rope ferries on the Cowlitz can be altered by raising the cables higher.

The same may be said of those on the Willamette River.

Very respectfully, your obedient servant,

W. A. JONES,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CHARLES F. POWELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, December 12, 1884.

SIR: I have the honor to submit the following * * * report of certain structures which interfere with navigation, and the best means of changing them for prevention of such obstruction. To these reports I have added some statements about dumping material into navigable waters or their tributaries.

* * * * * * *

OBSTRUCTING BRIDGES OVER WATERS OF YAQUINA BAY, OREGON.

The Willamette Valley and Coast Railroad Company have built in the last year, and now maintain, low fixed bridges over the tide-water sloughs—Boone's, Depot, and Olallie—of Yaquina Bay or River and near the entrance to the sloughs.

There is a county wagon-road bridge over Depot Slough, about 1½ miles from its mouth.

Boone's Slough makes off from the north side of the river, about 8½ miles above Newport, the port at the entrance to the bay, runs around an island and back into the river, under the name of McGee's Slough.

About 12 miles above Newport, Depot Slough extends northward almost to the Siletz Indian Reservation. It drains quite an extent of country, which contains some excellent ranches and most of the available timber on the waters of the Yaquina. There is a saw-mill above the county bridge, to which a small schooner has been for lumber in former years. The railroad bridge is next above Toledo, a small landing one-half mile up the slough.

Olallie Slough is about parallel to Depot Slough, and 1 mile above it. The slough has been ascended several times for over a mile by the United States tug *Wright*, drawing 7 feet. The Government has heretofore moored its floating-plant, except the tug, up the slough when work was suspended. The stone-barges can be taken under the bridge, but not the derrick-scow nor pile-driver.

All these bridges are wood, resting on pile-bents. The lower chords of the spans are about 5 feet above the highest tide-level. The mean rise of tide is 7 feet.

The railroad bridges at Boone's and Depot sloughs have 20-feet openings over the channel. The Olallie Slough bridge has a 30-feet opening.

The requirements of present commerce on these sloughs are not pressing, and the obstructions do not now greatly inconvenience any one. But the sloughs are easily navigable at high tide from one-half to 2 miles by vessels of 6 and 7 feet draught.

Boone's and McGee's sloughs are so shallow and unimportant that a change in the railroad bridges over them is not deemed necessary; but at Depot and Olallie sloughs I think movable spans giving 40 feet clear width of opening should be provided.

OBSTRUCTING BRIDGES ACROSS THE LOWER WILLAMETTE RIVER, OREGON.

These are two unfinished bridges at Portland, and below the head of ship navigation. One is the Morrison Street wagon bridge, and the other is the North Pacific Railroad Bridge. The former consists of a number of piers, some of them submerged; and the latter of two large clusters of piles, as rest and protection piers, above and below an intended pivot-pier. These structures, especially the Morrison street ones, are a menace and danger to navigation, and should be wholly removed.

A history of these unfinished bridges, showing their degree as obstructions and their legal status, is given in the Reports of the Chief of Engineers, pages 2657, for 1882; 2003, for 1883, and in Appendix QQ 1, for 1884.

BAR-NET FISHING AT THE MOUTH OF THE COLUMBIA RIVER AND FISH-TRAPS.

A special report on bar-net fishing and fish-traps at and near the mouth of the Columbia was made to the Department last November (10th).

The report was occasioned by the reference to me of a letter from the Treasury Department.

I had previously called attention in annual reports to an injurious effects on the bar-channels of the net-fishing; and in the special report referred to above I took occasion to say that—

> I have not seen any reason during the last two years to change my opinion of the injurious action of the fishing-nets on the channels; nor that the prevention of the bar-fishing would not retard the salmon-canning interests of the Columbia River.

Pilots have filed written complaints in this office of fish-traps as obstructions to navigation in the Swinomish Slough, a passage of Puget Sound between Seattle and Whatcom, and of traps in the Lower Columbia River 1 mile below Astoria, and at Chinook Point, between Astoria and Fort Canby.

The fish-traps consist of a long lead running out from shore and a large pen or trap at the outer end. Both parts are made of piling, and sometimes the lead, and always the trap, of a net-work of strong materials attached to the piling.

Many of these traps exist in the Lower Columbia River. Their use is being introduced into other rivers of the Oregon and Washington coasts.

A tracing* is sent herewith showing in plan the fish-traps of Baker's Bay, near the mouth of the Columbia, for furnishing a measure of their extent and agency in obstructing or filling up a channel-way.

The traps of Swinomish Slough and near Astoria should be removed.

In the special report of November 10 the fish-traps were described as permeable dikes, which check the current and cause a fill behind them. The following remarks are quoted from that report:

> These traps are coming into extended use in the Columbia River, from the mouth to near the Willamette River, about 100 miles distant. They have been generally located, so far, to the advantage of the main channel; but efforts have been made to build traps where they would be detrimental to it and obstructive to passing vessels.
>
> When requested, I have, as engineer in charge of the improvement of the Lower Columbia River, recommended about the location of a fish-trap. Pilots have prevented, I believe, the building of traps at places where they would encroach upon the ship-channel by threats of the destruction of the traps.
>
> No authority is exercised or delegated by the State in locating or limiting fish-traps. They are built as a right of the land-owner, the same as a public wharf or landing-pier should be.
>
> In order to preserve and maintain the ship-channel, the planting of fish-traps, as the building of other structures in the river, should be under active control of some authority fully advised of present and probable future improvements for navigation of the river and in harmony with the work thereof.

LOG-BOOMS IN NAVIGABLE WATERS.

On the left bank of the Coquille River, Oregon, above Coquille City, the piling of a log-boom has made an extensive shoaling at its site, destroying a river landing and deflecting the current to the opposite shore, causing bank caving and an undesirable change of channel.

On the Willamette River, Oregon, at Portland, a pile log-boom, occupying about one-third of the river's width, has aided in deflecting the river volume to a channel naturally inferior for harbor purposes and those of ship navigation, thereby causing public improvements to be made to this channel when a different one would otherwise have been more advantageous.

A pile-boom has been built across the mouth of the Dwamish River, Washington. An opening was left for steam-boats. The boom has now been abandoned; some of the piles are broken at low water, and form obstructions to navigation. This boom, as well as the one in the Willamette River, should be wholly removed. The latter is now within the corporate limits of Portland. A municipal ordinance requires the removal of portions exterior to an established wharf-line within six years.

---

* Tracing omitted.

DUMPING IN NAVIGABLE WATERS OR THEIR TRIBUTARIES.

It has been my observation that serious detriment to navigation and much expense in improvements therefor have been caused by a dumping in the water-ways of this district of miscellaneous materials, from sawdust and sweepings to trees. * * *

The Government is engaged in improvement by snagging operations of six rivers of this engineer district. Most of the snags or pieces of drift-jams are trees washed out from banks or are saw-logs. It is not uncommon, however, to find drifts made of tree trunks or stumps which have been cut in two.

On the Coquille River are many bars formed by drift of myrtle, a wood too heavy to float. I have noticed a very bad bar next above the head of present navigation, formed in this way.

Much earth and rock were dumped into Yaquina Bay and River by the railroad construction already referred to. This curtailed, to a small extent it is true, but injuriously, the tidal volume, and doubtless caused some shoaling on the bars. This dumping was not only to make a railroad grade, but sometimes a spoil-bank was formed in the water.

Under date of June 17, 1884, Joseph Thompson, of Toledo, Oregon, wrote me that—

> Parties up the bay, where the channel is narrow, are complaining of the railroad company for depositing so much dirt and rock in the river, and wished me to write to you in regard to the matter.

On August 8, 1884, Mr. B. Morrison wrote me, from Pioneer, Oregon, as follows:

> I am in the grocery business here and have a farm of land, and the Yaquina River runs through my place. Officers of the O. P. R. R. and others are filling up the channel of Yaquina River with rock and timber and obstructing the navigation thereof. Steam-boats have run to my place, and now I can not receive goods with a row-boat, and it costs me extra for teams and depreciates the value of my place $1,800.

On August 6, 1884, Mr. George C. Boswell, of Elk City, Oregon, wrote me as follows:

> I wish to inform you that the O. P. R. R. is filling up the river above Elk, a navigable river, meandered above where they are doing the damage, and it is impossible for me to get out with my scow at present. There was a great travel on this part of the river before they filled it with rock and timber.

* * * * * * *

> If there is $40,000 appropriation for Yaquina Bay, why not keep the river open, as we have a good sand-rock quarry here, and working men in it dressing stone, and expect to ship with scows to Yaquina schooners.

The wasting of sawdust in the Lower Willamette and Columbia rivers has been quite common.

A written complaint was lately made by a vessel master of the injurious action in the channel of a sawdust dumping in the river at an Astoria mill. Near Portland some of the mills have erected frail bulkheads behind which to place their sawdust.

There is an Oregon statute prohibiting the dumping of sawdust in the rivers below the Cascades and the Willamette Falls, but practically the law is of little avail, if any at all.

Perhaps the most aggravated case of river dumping in this district is at Portland and East Portland. The worst bar of the river ship-channel is next below these cities. Dredging has been prosecuted here to a considerable extent. Cans, matting, shoes, ashes, and other refuse have been frequently found in the dredging.

Masters of steam-vessels have complained about floating harbor débris as endangering the wheels of their craft when passing.

It has been noticed when Portland wharves are rebuilt that a considerable part of the old material is disposed of in the river, and that boxes, crates, packing material, etc., are sometimes thrown into the river or on the bank where high water will float them.

Reports have also been made of a deliberate dumping over open wharves from carts at night.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Captain of Engineers.

TO THE CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, February 24, 1887.

The Secretary of War has the honor to transmit to the United States Senate a letter of the 21st instant, from the Chief of Engineers, copies of correspondence relating to the bridge proposed to be built across the Hudson River at Poughkeepsie, and to the railroad bridge across the Mississippi River, at Saint Paul, together with copies of reports of officers in charge of river and harbor districts, made to meet the requirements of section 4 of the river and harbor act of August 5, 1886, that reports be made to Congress whether any bridges, causeways, or structures of any kind, now erected or in process of erection, do or will interfere with free and safe navigation.

WM. C. ENDICOTT,
Secretary of State.

The PRESIDENT PRO TEMPORE UNITED STATES SENATE.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 21, 1887.

SIR: I have the honor to submit herewith, in compliance with your instructions of January 19, copies of correspondence relating to the bridge proposed to be built across the Hudson River at Poughkeepsie and to the railroad bridge across the Mississippi at Saint Paul. The report of the Board of Engineer Officers, constituted to consider the proposed construction of a bridge across the Willamette River at Portland, Oregon, has not as yet been received, but will be duly submitted, as required.

I have also the honor to submit, in further compliance with your instructions, copies of reports from officers in charge of river and harbor districts, made, under orders from this office, to meet the requirements of section 4 of the river and harbor act of August 5, 1886, that reports be made to Congress whether any bridges, causeways, or structures of any kind now erected, or in process of erection, do or will interfere with free and safe navigation.

The instances herein enumerated of such interference are, with few exceptions, such as were not included in the communication of this office of December 12, 1885, made to comply with similar provisions of the river and harbor act of July 5, 1884, and which was transmitted to the Senate December 18, 1885, and printed as Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

HON. WM. C. ENDICOTT,
Secretary of War.

BRIDGE ACROSS THE HUDSON RIVER, NEW YORK, AT POUGHKEEPSIE.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., January 11, 1887.

SIR: I have the honor to acknowledge the reference to this office of letters from Henry D. Moore, esq., of Leadville, Colo., dated October 30, 1886, and F. Vosburg, manager Schuyler's Steam Tow Boat Line, and W. W. Everett, president of People's Line Steamers, dated November 3, 1886, calling attention to a proposed bridge across the Hudson River, New York, at Poughkeepsie, and protesting against its construction, and, in connection with the subject, to invite attention to the accompanying letter from Lieut. Col. Walter McFarland, Corps of Engineers, and inclosed communication of the Chief Engineer of the bridge company,* submitting plans for the bridge, &c.

In reply I beg to say that, so far as is known to this office, there is no authority of United States law for the erection of the bridge in question, and in the absence of such law the Executive branch of the Government is without power either to authorize or prevent its construction.

There are several bridges constructed or in course of construction across navigable waters of the United States, notably one across the Mississippi River at Saint Paul, which was referred to in the Annual Report of the Secretary of War, dated November 30, 1885 (see page 29, Report of the Secretary of War, vol. 1, 1885), and one in course of construction across the Willamette River at Portland, Oreg. In regard to the former, upon proper representations that it would materially obstruct and impede navigation, request was made by the Secretary of War to the Attorney-General that proceedings be instituted in behalf of the United States with the view of preventing its construction; but upon examination the Attorney-General found that he was without power to intervene, and held "that, until Congress acts and by appropriate legislation assumes control of the subject, the power of the State over bridges across navigable streams within its limits is plenary; but that when this power is exercised so as to unnecessarily obstruct navigation, Congress may interfere and remove the obstruction." The opinion concludes as follows:

> I am accordingly inclined to the conclusion that in the existing state of the law the facts of the present case (as they appear in the accompanying papers) afford no

---

* Omitted.

ground for a judicial proceeding *on behalf of the United States* against the railroad company; and that until Congress makes some adequate provision upon the subject, the officers of the United States can in this case take no action "to enforce the rights of the Government and give effect to the duty resting upon it to protect the navigation of the Mississippi River." (Opinion dated May 1, 1885.)

The proposed bridge across the Hudson River at Poughkeepsie is authorized by the State of New York, and comes within the purview of the opinion of the Attorney-General above quoted.

In view of the above statements it would seem to be obviously necessary that Congress should take action in reference to the construction of bridges over navigable waters of the United States by delegating such power to the Executive branch of the Government as will enable it, when necessity demands, to intervene for the protection of navigation and the preservation of the vast commercial interests which depend upon that mode of transportation of its goods and supplies to market.

This delegation of power in such restricted form as Congress, in its wisdom may see fit to grant, is, it is also suggested, more particularly to be desired in view of the large sums expended by the United States for the improvement of rivers, &c.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WM. C. ENDICOTT,
Secretary of War.

[First indorsement.]

WAR DEPARTMENT, *January* 19, 1887.

The Secretary of War approves the letter of the Chief of Engineers of the 11th instant, but in view of the provisions of section 4 of the river and harbor act, approved August 5, 1886, which require the Secretary of War to report to Congress whether any bridges, causeways, or structures now erected, or in process of erection, do or will interfere with safe navigation, he desires a report not only as to the bridge across the Hudson River at Poughkeepsie, N. Y., but also as to the bridge across the Mississippi River at Saint Paul, Minn., and the one at Portland, Oreg., and upon such other structures now erected or in process of erection as do or may interfere with free and safe navigation, and which, from the character of the river and the extent of commerce on it, should be called to the attention of Congress.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

LETTER OF HENRY D. MOORE.

LEADVILLE, COLO., *October* 30, 1886.

MY DEAR SIR: I take the liberty of calling your attention to a matter of much public importance, if not of great National interest, for many of the States in the Union are directly or indirectly interested in it, and as it comes under the jurisdiction of your Department, I trust you will excuse the liberty I have thus taken. Some sixteen or seventeen years ago, a bill was passed by the legislature of the State of New York, giving authority to build a bridge over the Hudson River at Poughkeepsie, in the State. It was to be a bridge with five or six piers in the river, and the company obtaining this charter commenced work on the structure, and sunk two caissons in the river and partly erected two of the piers, when strong remonstrances against the building of it were sent to Congress from the city of New York, and as I am informed, the lower House of Congress at once passed a resolution forbidding the work to go on. The resolution did not reach the Senate for the reason, I suppose, that the work was then abandoned and nothing has ever been done upon it since, and the two partly constructed piers have been standing there for the last fifteen years, a menace to the free and safe navigation of the river. Since that time the State of New York has invariably, and I think most properly, refused to allow any pier bridge to be erected over that river, and when the constitution of the State was altered, a clause was inserted in it forbidding the bridging of the Hudson River in any manner without special authority from the legislature.

During the last six years two bills were forced through the legislature giving authority to build a pier bridge at Storm King Mountain, below Poughkeepsie, and both bills were most properly vetoed by the governor, and the last one, I think, was vetoed three years ago by our now most worthy President, Cleveland, who was then governor of the State.

After the Storm King party found that it was impossible to get the right from the State to build their pier bridge, they then went to Washington to get the authority of Congress to build it, and for four years various bills were introduced for that purpose, but at once remonstrances from the "Board of Commerce" and the "Hudson River Navigation Company" of New York, and other sources, were sent to Washington, and the legislature of the State passed resolutions instructing their Senators in Congress to oppose the bills, and of course the right was never granted.

I have been thus particular, Mr. Secretary, in stating these facts, that you may know how strong is the feeling now of the people of the State of New York, and of Congress also, against obstructing the free and safe navigation of that important river by placing piers of rock and masonry in the channel of that great highway of commerce and navigation, and, as preparatory, also to the main object of this letter, which is to call your attention to the fact that the old project of sixteen years ago, of building the Poughkeepsie Bridge with five piers in the river, has been recently revived in some unaccountable manner as you will see by the inclosed extracts from New York papers, and the present proprietors of that charter propose to do this *at once*, and without any authority whatever from Congress for doing it. They seem to be oblivious of the fact that Congress has jurisdiction over the navigable rivers of our country, and to the fact, also, that in the recent act of Congress, ap-approved August 5, 1886, known as the "river and harbor act," the Secretary of War is requested "to report to Congress, in his annual message, whether any bridge now erected, or in process of erection, over any navigable river, will interfere with the free and safe navigation thereof." Is it not remarkable that any company or corporation would ignore all of these facts, and persist in doing the work which they are now credited with doing? And if your honor will allow me, in order to show you the feeling in the legislature of New York on this subject, I will quote very briefly from a debate in the senate when the last Storm King bill was defeated. Senator Newbold, who strongly opposed that bill, said:

> He was opposed to the Poughkeepsie bridge also, and thought a million of dollars would be well spent in removing the cassions sunk.

And Senator Fassett said:

> The clearest objection to the bill is that the Hudson River is a navigable stream, and Congress has control over it. Congress has refused time and again to authorize this bridge, on the ground that it impeded navigation, and until Congress acted the legislature should not.

And yet, in the face of all these facts, this company now proposes, not only to rebuild those two old piers which have partly gone to destruction, and to remove which Senator Newbold said "a million dollars could be well spent," but they intend also to erect three additional piers by the side of them; and they propose to do this, as I have said, without any authority from Congress whatever, and in a river over which hundreds of millions of dollars in trade, traffic, and commerce is annually carried.

I trust you will excuse me for troubling you with this long communication; but inasmuch as by the act of Congress such matters come under the jurisdiction of your Department, I have thought it possible that some of the facts I have mentioned may never have been called to your attention.

With much respect, your obedient servant,

HENRY D. MOORE.

Hon. W. C. ENDICOTT,
Secretary of War.

LETTER OF THE MANAGER OF THE SCHUYLER STEAM TOW-BOAT LINE, AND OF THE PRESIDENT OF THE PEOPLE'S LINE STEAMERS.

OFFICE OF SCHUYLER'S STEAM TOW-BOAT LINE,
New York, November 3, 1886.

SIR: By an act making an appropriation for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, approved August 5, 1886, it was provided, amongst other things, in reference to the duties of the Secretary of War—

> He shall report, at the same time, whether any bridges, causeways, or structures now erected, or in process of erection, do or will interfere with free and safe navigation.

We have, therefore, the Honor to call the attention of the Honorable Secretary of War to the fact that in the Hudson River, opposite Poughkeepsie, there are already two serious obstructions made by the Poughkeepsie Bridge Company, portions of which are above water and others below; and it is currently rumored that this bridge company purpose to put several other similar obstructions in this important water-way. In fact, the public newspapers announce that they are to put ten piers in all across the Hudson River opposite Poughkeepsie.

It cannot be denied that these piers, if built, and those that are already partially done, are very great obstructions to the navigation. It frequently occurs that our tows are from thirty to sixty barges and canal-boats at a time.

There is no occasion for these obstructions, as there are places quite as easily reached by railroad, if not more so, by bridging the Hudson River where no piers or obstructions of any kind will be required.

We earnestly urge that immediate steps may be taken, officially, to ascertain the facts in this case, in oder that the same may be reported to Congress.

We are, very respectfully, your obedient servants,

F. W. VOSBURGH,
Manager Schuyler Steam Tow-Boat Line.
W. W. EVERETT,
President People's Line Steamers.

To the Honorable the SECRETARY OF WAR.

LETTER OF LIEUTENANT-COLONEL WALTER M'FARLAND, CORPS OF ENGINEERS.

ENGINEER OFFICE, U. S. ARMY,
New York, N. Y., December 23, 1886.

GENERAL: I have the honor to report as follows in relation to the Poughkeepsie Bridge now building across the Hudson River, complaints against which from Henry D. Moore and from the manager of Schuyler's Steam Tow-Boat Company were referred to me from your office under date of November 10, 1886.

The bridge is being built under an act of the State of New York incorporating the Poughkeepsie Bridge Company, passed May 10, 1871, subsequently amended by other acts, so I am told by Mr. Dickerson, the chief engineer of that company, extending the period for the completion of the bridge to January 1, 1888.

No authority has been procured from Congress for the construction of this bridge, but there is no law I believe requiring this.

The general requirements of the amendatory act of May 25, 1872, in relation to this bridge are—

"That the shore abutments of said bridge shall not be constructed beyond the river line" of certain docks, that the piers of masonry shall not exceed "four in number, at a distance from each other and from the shore abutments of not less than 500 feet," and "the elevation of said bridge shall be at least 130 feet above high water."

These requirements are provided for in the plan which has been sent me as official, and which I transmit herewith, two of the spans being of 500 feet, 6 inches each, and the other three being 518 feet, 521 feet, 6 inches, and 518 feet, respectively, while the lower chords of two of the spans are 130 feet above high water, and more than half of each of the other three spans have their lower chords 160 feet above high water.

This matter was referred to General Newton by letter from your office dated December 19, 1873, and he reported upon it under date of January 15, 1875. In that report he says:

> The cross-section remaining after the piers are placed in would still be more than that of the natural river at Blue Point, below the city. The height given to the bridge and the distance apart of the piers offer the least possible inconvenience to navigation. I recommend, therefore, that no opposition be made to the proposed structure, provided its interference with the river and with navigation be kept within the limits defined in the sketches and letters sent herewith.

I agree in this opinion. I send herewith a letter from the chief engineer of the bridge company, with two blue print plans of the bridge and a printed copy of the act of incorporation.

Very respectfully, your obedient servant,

WALTER MCFARLAND,
Lieut. Col. of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

BRIDGE OF THE MINNESOTA AND NORTHWESTERN RAILROAD ACROSS THE MISSISSIPPI RIVER AT SAINT PAUL, MINNESOTA.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., November 28, 1884.

SIR: Your letter of the 22d instant, stating that information has reached you of the intention of the Minnesota and Northwestern Railroad Company to commence the construction of a railroad bridge over the Mississippi River at Saint Paul, Minn., &c., has been received.

While the Secretary of War is not, in the absence of Congressional legislation, authorized either to approve or forbid the erection of bridges over navigable waters of the United States, if he is satisfied that any intended structure of that kind or any other will seriously impair the navigation of the channels of the navigable waters of the United States, he has not failed to endeavor, through the Department of Justice, to prevent the erection of such structures. You are therefore requested to inform the railroad company under whose direction the proposed bridge is to be erected, that if the navigation of the Mississippi River is to be seriously impaired or obstructed by its erection, proper steps will be taken to protect the interests of the Government in the premises, through the Department of Justice. In order to avoid possible trouble in the future it might be advisable for the company to obtain the authority of Congress for the erection of the bridge before undertaking its construction.

By command of Brigadier-General Newton.

Very respectfully, your obedient servant,

JOHN G. PARKE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

Maj. A. MACKENZIE,
Corps of Engineers.

BRIDGES ACROSS THE MISSISSIPPI RIVER AT SAINT PAUL, MINNESOTA.

DEPARTMENT OF JUSTICE,
Washington, April 3, 1885.

SIR: I have to acknowledge the receipt of your letter of March 27, 1885, with inclosures relative to the proposed construction of bridges over the Mississippi River at Saint Paul, Minn. You said:

> As it appears from said letters that the plans of the proposed bridges do not conform to the requirements of law, and that the construction of the bridges in accordance with said plans may possibly affect the interests of navigation, I beg to request that you will please cause such measures to be taken as may be deemed necessary to protect the interests of the United States in the premises.

In accordance with your request the district attorney was written to on February 10, 1884, as follows:

> It is claimed, in regard to the first-mentioned bridge, that while there is an authority of law for its construction, yet it is being constructed contrary to the provision of the act which provides that it "shall not interfere with the free navigation of said river beyond what is necessary in order to carry into effect the rights and privileges hereby granted," and the other provisions contained in the second section of the said act. And in regard to the bridge proposed to be erected by the railroad company, it is alleged that there is no authority in law for the erection of this bridge. By reference to the act, you will see that the city of Saint Paul is authorized to erect, &c., or to *authorize* the erection, &c., of one or more foot and carriage or railroad bridge and bridges across the Mississippi River. It may be that the authority for the erection of this second bridge by the railroad company has been derived from the city of Saint Paul under the provisions of this act.
>
> You are instructed to investigate the statements made by Major Mackenzie and to report whether in your opinion there is a necessity for any proceedings at law or in equity for the enforcement of the provisions of the act of August 5, 1884, in respect to these bridges; also under what authority the railroad company in fact has undertaken to erect the draw-bridge mentioned.

I have the honor to hand you herewith copy of District Attorney Searle's report under the above instructions. He, you will observe, is of the opinion that for the reason stated by him "there is no necessity for any proceedings at law or in equity relative to the two bridges referred to."

I have to request that you will advise me whether you are satisfied with the conclusions reached by Mr. Searle, or if not whether you desire me to further instruct him, and how.

Very respectfully,

A. H. GARLAND,
Attorney-General.

The SECRETARY OF WAR.

LETTER OF THE DISTRICT ATTORNEY TO THE ATTORNEY-GENERAL OF THE UNITED STATES.

DISTRICT OF MINNESOTA,
Saint Paul, March 30, 1885.

SIR: Replying to your letter of 10th ultimo, wherein you instruct me to investigate the statements made by Major Mackenzie, and to report whether in my opinion there is a necessity for any proceedings at law or in equity for the enforcement of the provisions of the act of August (July?) 5, 1884, in respect to two bridges now being built across the Mississippi River at Saint Paul, one by the city of Saint Paul, and one by the Minnesota and Northwestern Railroad, and also to advise you under what authority the railroad is building its bridge, I have to say that immediately upon receipt of the same I communicated with the city and the railroad officials relative to the matters therein referred to, and have just received this day a reply thereto from the mayor of Saint Paul. Hence my delay in replying.

(1) *In regard to the city bridge.*—Upon examining the proposed site of this bridge I find that no steps have been taken as yet towards its construction, and from copies of letters which you inclosed me from Mayor and City Engineer of Saint Paul, dated January 9 and 10, 1885, and a copy of my letter to the Mayor of Saint Paul, dated February 14, 1885, and the inclosed letter of the Mayor, dated March, 1885, it would appear that the city does not intend to begin the construction of said bridge until the plans therefor have been approved by the Honorable Secretary of War, as required by section 4 of said act. So far, therefore, as this bridge is concerned, I can see no necessity for any action whatever, as yet.

(2) *In regard to the railroad bridge.*—I inclose a letter from A. B. Stickney, esq., president of the railroad, concerning the whole ground.

It appears therefrom that this bridge is being built under authority contained in its charter, which was enacted by the late Territory of Minnesota, March 4, 1854, and is entitled "An act to incorporate the Minnesota and Northwestern Railroad Companies," and several acts amendatory thereof. It further appears that the bridge is not being built under any authority conferred by the city of Saint Paul, pursuant to the act of July 5, 1884 (chapter 215) nor under any other act of Congress. It would therefore follow that chapter 281, approved June 4, 1872 (17 Gen. Stat., 215), is misapplicable to this bridge. It therefore follows, as I understand the case of Escanaba and Lake Michigan Transportation Company *vs.* Chicago, 107 U. S., 678, that in the absence of any such act of Congress the legislature of Minnesota has full power to authorize the construction of this bridge, and that the public authorities of the United States have no power to interfere with it upon their own motion, even should it unnecessarily obstruct the navigation of the river.

But after examining the bridge, I am of the opinion that it does not unnecessarily obstruct the navigation of the river. There is a water-way of 150 feet on each side of the pivotal pier. The water-way of the bridge at Hastings is but 130 feet. As Hastings is 20 miles below this bridge, it follows that every boat that passes through this bridge must first pass through a water-way 20 feet narrower than that here afforded.

I may add that most of the boats land at levees below this bridge, and that the commerce above it is comparatively trifling.

I would therefore state that in my opinion there is no necessity for any proceedings at law or in equity relative to the two bridges referred to in yours of the 10th instant.

Respectfully,

D. B. SEARLE,
United States Attorney.

Hon. ATTORNEY-GENERAL.

LETTER OF THE SECRETARY OF WAR TO THE ATTORNEY-GENERAL OF THE UNITED STATES.

WAR DEPARTMENT,
Washington City, April 15, 1885.

SIR: I have the honor to acknowledge the receipt of your letter of the 3d instant, with inclosures relative to the proposed construction of bridges over the Mississippi River, at Saint Paul, Minnesota, and in reply to state, so far as the bridge contemplated to be built by the city authorities at that point is concerned that, through correspondence and conference had by this Department with the Mayor of that city, it is believed that a result satisfactory to all concerned will doubtless be reached at an early period. This bridge is to be constructed under the provisions of an act of Congress approved July 5, 1884. It appears from the communication of the United States District Attorney at Saint Paul, however, that the railroad bridge across the Mississippi now in process of construction at nearly the same point as that selected for the city bridge, and underneath it, has never been authorized by Congress, but that the corporation engaged in the work claim to have been fully empowered in that behalf by an act of the Territorial legislature of Minnesota, passed in 1854, and acts amendatory thereof. The District Attorney expresses himself as satisfied that the authority claimed is ample, and that no proceedings at law or in equity are necessary in the premises. In his conclusions I am unable to concur, and beg to call your attention to the delay which occurred on the part of that officer to report upon the matter submitted to his care. The letter of the President of the railroad company to him, the claims in which he concedes and makes the basis of his own judgment, bears date February 19, 1885, while his own letter does not appear to have been written until March 30, succeeding. In the mean time, as this office is informed by a reputable citizen of Saint Paul, such rapid progress has been made in the work that the piers of the bridge are about ready for the superstructure to be placed upon them.

It is remarked that while in the act authorizing the city of Saint Paul to construct bridges Congress appears to have exercised great care in providing proper restrictions as to the height and width of spans, the railroad bridge is being built near the water and regardless of the right of supervision which has been repeatedly declared by Congress to be inherent in the General Government. It is also remarked that although the act of July 5, required that the main span of bridges over the channel of the stream should be 250 feet, the plan submitted for my approval contemplated a span of 300 feet, and this office is advised that a pier of the railroad bridge placed in the channel is 40 feet in width.

The papers relating to this matter are herewith returned, and the question is submitted for your determination as to what action shall be taken to enforce the rights of the Government and give effect to the duty resting upon it to protect the navigation of the Mississippi River.

Very respectfully, your obedient servant,

WM. C. ENDICOTT,
Secretary of War.

The Honorable the ATTORNEY-GENERAL.

LETTER OF THE ATTORNEY-GENERAL OF THE UNITED STATES TO THE SECRETARY OF WAR.

DEPARTMENT OF JUSTICE,
Washington, May 1, 1885.

SIR: Your communication of April 15, 1885, with accompanying papers relative to the matter of the railroad bridge across the Mississippi River at Saint Paul, Minnesota, has been received, and I beg leave to reply as follows:

It seems a railroad bridge is being constructed by the Minnesota and Northwestern Railroad Company across the Mississippi River at Saint Paul, with a pivot-draw over the main channel, under the authority of an act of the Territory of Minnesota, entitled "An act to incorporate the Minnesota and Northwestern Railroad Company," and acts amendatory thereof, and also under the alleged authority of the general laws of the State of Minnesota.

By the act of Congress of July 5, 1884, chap. 215, power is given to the *Common Council of Saint Paul* to erect or to authorize the erection of "one or more foot and carriage or railroad bridge or bridges across the Mississippi River, extending from such point or points to be selected as lie between the easterly and westerly boundaries of said city to a point or points on the opposite side of said river, now known as the sixth ward of said city," &c. The act further provides that any bridge or bridges built thereunder may, by direction of said Common Council, be built as a draw-bridge, with a pivot or other form of draw; and, if built as a draw-bridge, that the draw shall be over the main channel of the river at an accessible and the best navigable point, with spans giving a clear width of water-way of not less than 160 feet on each side of the central or pivot pier of the draw, &c.

The bridge in course of construction by said company is located within the limits described in the last-mentioned act, and while the spans of its draw give a narrower water-way than is required by that act (it being but 150 feet on each side of the pivot-pier), this bridge in other respects fails to meet the requirements of the same act.

Such is substantially the case presented by the papers, and you submit for my determination the question "as to what action shall be taken to enforce the rights of the Goverment, and give effect to the duty resting upon it to protect the navigation of the Mississippi River."

As the Mississippi River above, at, and for some distance below the city of Saint Paul is wholly within the State of Minnesota, the principle enunciated by the Supreme Court of the United States in Wilson *vs.* the Blackbird Creek Marsh Company (2 Pet., 250), Gilman *v.* Philadelphia (3 Wall., 713), Pound *v.* Turck (95 U. S., 459), and Escanaba Company *v.* Chicago (107 U. S. 678), applies to this case, namely, that until Congress acts, and by appropriate legislation assumes control of the subject, *the power of a State over bridges across navigable streams within its limits is plenary;* but that when this power is exercised so as to unnecessarily obstruct navigation, Congress may interfere and remove the obstruction. The power of Congress to regulate bridges over navigable waters is paramount, and where it comes in conflict with that of the State the latter necessarily becomes ineffective. Yet in the case last above cited the court observes that, "to render the action of the State invalid in constructing or authorizing the construction of bridges over one of its navigable streams, the General Government must directly interfere so as to supersede its authority and annul what it has been done in the matter;" and this doctrine is announced and recognized in Bridge Company *v.* United States (105 U. S., 470), and Miller *v.* The Mayor, &c. (109 U. S., 385), and especially by a decision rendered at the present term of the Supreme Court of the United States in Gloucester Ferry Company *v.* The Commonwealth.

Assuming, then, that the construction of the railroad bridge referred to is authorized by the laws of the State of Minnesota, this would seem to be sufficient for the purpose, unless the authority imparted by those laws is in conflict with, or has been superseded or invalidated by, Congressional legislation. If such authority is unaffected by any existing law of Congress, the railroad company above named may undoubtedly act thereunder, and in so doing it will only subject itself to the risk of *future Congressional interference.*

Congress has passed no general law regulating the erection of bridges across the Mississippi. Numerous acts have been passed by it, authorizing the erection of such bridges at particular localities, the provisions whereof are similar to those contained in the aforesaid act of July 5, 1884. That act does not expressly prohibit the building of any bridge at the locality therein described other than such as is authorized thereby, and whether it does so by implication is a question of construction. It declares that "any bridge or bridges constructed *under this act* and according to its provisions and conditions shall be a lawful structure or structures." If this affirmative declaration may be construed to include the negative one, viz, that "any bridge *not* constructed under this act, &c., shall be an *unlawful* structure," which is at least doubtful, it would in effect annul any authority derived under the State to erect a bridge of *any sort* in that locality.

But suppose the act has that effect, and the bridge now being erected by the railroad company is not a lawful structure, what action, if any, are the officers of the General Government authorized to take in the premises? There is no law of Congress under which criminal proceedings can be instituted by them; and without authority of Congress it is questionable whether of their own motion, and simply in vindication of the general public right of navigation, they can institute any civil proceeding on behalf of the United States, such as an information to enjoin the erection of the bridge, or to abate it, *as a nuisance* (see 15 Opin., 526). Where, however, the interests of the United States are directly concerned, as, for example, if the structure should threaten injury to or interfere with any work of the General Government for the improvement of the river, a civil proceeding to protect such work may be instituted in its behalf in the proper Circuit Court (U. S. *v.* Duluth, 1 Dill., 469). But as regards the right of navigation, the public law of the United States appears to leave the vindication of this right wholly to those who sustain injury thereto from unlawful obstructions or otherwise through the institution *by them* of appropriate civil proceedings for relief.

I am accordingly inclined to the conclusion that, in the existing state of the law, the facts of the present case (as they appear in the accompanying papers) afford no ground for a judicial proceeding *on behalf of the United States* against the railroad company; and that, until Congress makes some adequate provision upon the subject, the officers of the United States can in this case take no action "to enforce the rights of the Government and give effect to the duty resting upon it to protect the navigation of the Mississippi River."

Very respectfully,

A. H. GARLAND,
Attorney-General.

Hon. WM. C. ENDICOTT,
Secretary of War.

REPORT OF MAJOR JARED A. SMITH, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., December 30, 1886.

GENERAL: In compliance with instructions in General Orders No. 7, from Headquarters Corps of Engineers, dated November 30, 1886, I have the honor to submit the following report:

Regarding the railroad and highway bridge between Portsmouth, N. H., and Kittery, Me., my annual report for Cocheco River, New Hampshire, for fiscal year ending June 30, 1886, contained the following paragraph:

> The bridge across the Piscataqua River, near Portsmouth Harbor, has its draw very narrow and badly arranged, so that it is generally a very inconvenient, slow, and tedious process to pass vessels through. In passing through the draw with the tide it is in general necessary to moor the vessel and allow it to drop through the narrow space stern foremost, requiring great pains to accomplish it without injury.

My report of a preliminary examination on the Kennebec River, Maine, submitted on the 27th instant, contained the following paragraphs:

> The draw of the bridge from Gardiner to Pittston is difficult and somewhat dangerous to pass, owing to the lack of suitable piers as guides to the current and guards for the passing vessel. I give this upon the statement of pilots and others, without personal knowledge obtained from observation.
>
> The bridge seems to have had an effect in forming a shoal in front of the wharves immediately above, and the shoal has extended downward until it has injured the channel through the draw. Opposite the railroad wharf the shallow water causes great inconvenience and expense in getting vessels to and from the landing.

Referring to the injuries caused by a freshet in 1870, the same report says:

> The same freshet carried away the toll-bridge at Hallowell, leaving the piers in the river. The remains of the bridge piers are now submerged at high water and form a dangerous obstacle, on which many vessels have been injured.

I am informed that a railroad bridge is soon to be constructed across the navigable portion of the York River, Maine, for the improvement of which an appropriation was made by Congress August 5, 1886. So far as I am aware, no authority has been obtained from Congress for constructing the bridge mentioned, and it is therefore not known how far it may cause obstruction. In this connection it seems not improper to suggest the necessity for some general legislation on the subject of constructing new bridges over such navigable waters, so that the matter may be brought within the supervision of the proper department of the Government without special legislation on each case, or its evasion by constructing bridges without proper authority.

The points mentioned cover all that are known to exist within the limits of works in charge of this office.

Very respectfully, your obedient servant,

JARED A. SMITH,
Major of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL GEORGE L. GILLESPIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Boston, Mass., December 9, 1886.

GENERAL: In compliance with instructions contained in General Orders No. 7, Headquarters Corps of Engineers, United States Army, dated November 30, 1886, I have the honor to submit the following report with reference to obstructions to navigation, in the district under my charge, as specified in section 4 of the river and harbor act approved August 5, 1886, viz:

The bridges whose construction interferes with free and safe navigation are limited to the Fort Point Channel, Boston Harbor, and to the Charles River, Massachusetts, within the city limits of Boston, and are enumerated as follows:

A.—FORT POINT CHANNEL, BOSTON HARBOR.

The New York and New England Railroad Bridge interferes with free and safe navigation. This arises chiefly from an insufficient width of the draw openings, and from the frequent use of the bridge by railroad trains.

(*a*) Its draw openings are too narrow. The bridge is situated between the Congress Street (draw openings 43 feet 4 inches) and Mount Washington Avenue bridges (draw openings 42 feet 2 inches), being 500 feet from the former and 1,100 feet from the latter (see map accompanying report January 27, 1885). Its draw openings are 40 feet 7 inches wide, or 2 feet 9 inches narrower than the convenience of navigation demands.

The river and harbor bill approved August 5, 1886, contains an appropriation of $18,750 for the improvement of this channel; the approved project is for a channel 100 feet wide and 23 feet deep, from the Congress Street Bridge, eastward to a junction with the main ship-channel. The pivot-piers of the Congress Street and Mount Washington Avenue bridges rest upon piles driven 29 feet below mean low water; the deepening of the channel to 23 feet through their draws may therefore take place without requiring any modification of the piers. The pivot-pier of the New England Railroad Bridge rests upon piles driven to a depth of only 22 feet below mean low water, and whenever the Fort Point Channel improvement is carried beyond that bridge the existing pivot-pier will have to be reconstructed with piles driven to a least depth of 29 feet mean low water, and with draw openings not less than 43 feet 4 inches in the clear.

The reconstruction should take place at once.

(*b*) Complaints have been made that vessels are often delayed because the draws of this bridge are not promptly opened. This is due to the many trains which pass the bridge in quick succession. Under the law of the State of Massachusetts a railroad train is allowed fifteen minutes before and after its tabular time, and any approaching train further reasonable time, for crossing a draw-bridge. Hence when many trains are run at short intervals the draws may be continuously closed for many hours. The New England Railroad runs fifty-one passenger and fifteen freight trains over its draw-bridge daily. The same difficulty occurs at the Old Colony Railroad Bridge, near the entrance to South Bay, and the cause is the same.

No alterations of these bridges can overcome these difficulties noted. The inconvenience might, perhaps, be somewhat lessened by a change in the State law.

B.—CHARLES RIVER, MASSACHUSETTS.

The seven draw-bridges situated between the river's mouth and East Cambridge interfere with free navigation, owing to their proximity to each other.

Although the problem of rearranging and modifying these bridges has been often and thoroughly investigated, no practical plan consistent with the necessities of the railroad and city travel has been developed.

A few months ago the city made arrangements with the railroads by which the draws were kept continuously open for the use of vessels from 12 o'clock midnight to 4 o'clock in the morning. The arrangement proved impracticable, and was discontinued after about a week's trial, and a return was made to the old regulations of opening the draws at the convenience of the railroads. The frequent passing of trains renders delays in opening the draws unavoidable. This inconvenience is greatest in connection with the Boston and Maine Railroad Bridge, and the consolidated bridge of the Eastern and Boston and Lowell railroads, which has two independent draw-sections. These bridges are so near together that it is necessary for the passage of a vessel of the larger class navigating the river to have the *three draws open at the same time*. The time-tables of the three railways not being arranged with a view to facilitate navigation, this coincidence of openings is often impossible, and long delays occur. It is not unusual for the draws to be closed four or five hours continuously, morning and afternoon.

These difficulties cannot be obviated by any practicable alterations of the bridges so long as the railroad depots are kept where they now are and the approaches to them across the river are made oblique to the currents and concentrated upon a small area on the south shore.

The obstructions to navigation arising from the bridges crossing the Fort Point Channel and the Charles River cannot be removed or diminished by the construction of booms, dikes, piers, or any other structure for the guiding of vessels.

Very respectfully, your obedient servant,

G. L. GILLESPIE,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

NOTE.—A report upon the obstructions to navigation arising from the bridges above referred to, made by Maj. C. W. Raymond, Corps of Engineers, January 17, 1885, to comply with the requirements of the river and harbor act of July 5, 1884, was transmitted to Congress December 18, 1885, and printed in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

REPORT OF LIEUTENANT-COLONEL GEORGE H. ELLIOT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, R. I., December 21, 1886.

GENERAL: Referring to General Order No. 7, Headquarters Corps of Engineers, current series, respecting the interference with free and safe navigation by bridges, causeways, and other structures, I have the honor to state that the only case of general complaint within my district is that of the railroad bridge of the Boston and Providence Railroad Company, which crosses Pawtucket (Seekonk) River, Rhode Island, near its mouth, between the city of Providence and East Providence.

About 500 feet above this bridge is a highway bridge connecting the same places, which has recently been erected in lieu of the old Washington bridge, which was about 250 feet above the railroad bridge, and has been removed.

* * * * * * *

Although the passage of the draw of the railroad bridge has been somewhat ameliorated by the increase of distance between the two bridges, essentially the same difficulties are experienced as before, and as stated in my report of December 8, 1884, which was transmitted to Congress December 18, 1885, and published in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

The draw of the new bridge is well located near the middle of the channel and it has two draw openings each 80 feet wide in the clear.

The draw of the railroad bridge is not on or near the prolongation of the draw of the upper bridge, as it should be, but is near the eastern side of the river in a concave bend, and its single available draw opening is practically but about 45 feet wide.

The passage through the bridges is thus a very crooked one, and as the currents are swift, vessels cannot be taken through without damage to themselves and the guide piling leading to the openings in the two draws, and not infrequently tows get stuck in the narrow passage through the railroad bridge, suspending navigation for a time as well as the passage of trains.

In fact the only worse condition of affairs at the mouth of the Pawtucket, *above which* the General Government is improving the river at an estimated cost of more than $380,000, would be a complete barrier at the mouth to all navigation whatever, and as the existing condition cannot be much longer endured by the navigation interests of the Pawtucket River, it is a striking example of the impolicy on the one hand of any corporation or individual constructing any bridge over a navigable stream, without first obtaining the consent of Congress and the approval of the plans of the bridge, and on the other, of the United States permitting such construction without such consent and approval.

I should add that efforts have been made in the legislature of the State, with the view of the passage of a law by the State compelling the Boston and Providence Railroad Company to make the change desired; that is, to make the draw of its bridge conform both in position and width of draw openings to the draw of the highway bridge, but no such law has yet been enacted, and the railroad company claims, as I understand, that the draw of its bridge was made as directed by the State, in the act of the legislature of 1866, authorizing the construction of the bridge, and it will resist any law of the kind referred to that may be passed.

Very respectfully, your obedient servant,

GEORGE H. ELLIOT,
Lieut-Col. of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL D. C. HOUSTON, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, December 21, 1886.

GENERAL: In compliance with General Orders No. 7, Headquarters Corps of Engineers, dated Washington, D. C., November 30, 1886, referring to section 4 of the river and harbor act, approved August 5, 1886, I have the honor to report that the report of Col. Walter McFarland, Corps of Engineers, printed in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session, pages 7 to 13, contains all the information called for in reference to bridges, &c., in the district under my charge, the only change being in the Tomlinson Bridge crossing the mouth of the Quinnipiac River at New Haven, Conn. Alterations have been made in the bridge, so that complaints are no longer made.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Lieut. Col. of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

SUPPLEMENTARY REPORT OF LIEUTENANT-COLONEL D. C. HOUSTON, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, January 25, 1887.

GENERAL: I have the honor to report, as called for by General Orders No. 7, Headquarters Corps of Engineers, November 30, 1886, referring to section 4 of the river and harbor act, approved August 5, 1886, that the Washington Bridge across the Housatonic River at Stratford, Conn., seriously interferes with the safe navigation of the river.

This has but recently come to my knowledge through persons interested in navigation.

The Washington Bridge was chartered in 1803 and rebuilt in 1872. It is a highway bridge over the Housatonic River, Connecticut, between the town of Milford, New Haven County, and the town of Stratford, Fairfield County, situated about 2,000 feet below the New York, New Haven and Hartford Railroad Bridge. It is a wooden structure, Howe truss, about 600 feet long. The clear width and maximum low-water depth of the seven spans are as follows, beginning at the west bank:

Span.	Width.	Depth.	Span.	Width.	Depth.
	Feet.	*Feet.*		*Feet.*	*Feet.*
First	83	27	Fifth	83	27
Second	58	20	Sixth	83	23
Third	63	30	Seventh, and draw space	80	7
Fourth	83	33			

The draw turns on the east abutment, and when closed one end of the swing lies over the east bank. The riprap protection to the pier decreases the available opening to 70 feet. I am informed that recently this has been further diminished by the falling in of a part of the abutment. The condition of the channel above and below the bridge would make the natural course of vessels about where the pier, between the fifth and sixth spans, now stands; instead of which, in order to pass the draw, they have to head close into the east shore, and after passing, turn away from it abruptly. The difficulty of making this turn, particularly to boats in tow, is increased by the swift tidal current.

To remedy this the fifth and sixth spans should be made the draw-spans. Vessels could then take a more direct course, as well as have a greater depth of water. Changing the present pier between these spans to a turning pier would decrease the available width of spans to about 70 feet. This width should be increased to that of the railroad bridge draw, which is the only other bridge over the navigable part of the river.

Very respectfully, your obedient servant,

D. C. HOUSTON,
Lieut. Col. of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., January 7, 1887.

SIR: I have the honor to submit the following report in compliance with General Orders, No. 7, Headquarters Corps of Engineers, United States Army, November 30, 1886, relative to "whether any bridges, causeways, or structures now erected or in progress of erection do or will interfere with free and safe navigation."

Every bridge over a navigable stream interferes more or less with "free and safe navigation." On the Schuylkill River, for instance, there are five bridges below Chestnut street, each one with a draw-span varying from 180 feet to 50 feet in width. The 50-foot span should have been wider, and whenever that bridge (the Gray's Ferry Bridge) is rebuilt the draw-span should be widened. None of these five bridges, however, interfere with navigation sufficiently to call for any change at present. Above Chestnut street the bridges have no draws, and it is proposed to place a bridge without a draw one block lower down, at Walnut street, which would make five bridges without draws between Walnut street and the dam at Fairmount, the head of navigation. These bridges are an obstruction to navigation, which is thereby limited to barges and canal-boats, with an occasional sailing vessel whose masts have to be taken down to pass under the bridges. But the interference of these bridges with navigation is as nothing compared with the interference with land transportation that would be caused by placing draws in them. The Market Street Bridge has passing over it a double line of cable cars, while, as I am informed, about 800 passenger trains and 400 other trains, including freight-cars and detatched locomotives, cross the Pennsylvania Railroad Bridge daily. All the commerce above Walnut street can be amply accommodated by barges and canal-boats, and I would unhesitatingly say that the interests of commerce as a whole do not require draws in these bridges.

The bridges on the smaller streams tributary to the Delaware generally have draws, but it would doubtless have been better if they had been wider. These bridges are usually tended by some one living near by, and I presume that the crews of the boats often have to open the draws themselves, as it would not pay to keep a bridge-tender always on the ground. Of course these bridges are an obstruction to navigation, but I have never heard of any complaints on the subject.

As far as my information extends there is no bridge in this District that is, on the whole, an unfair injury to navigation and commerce when considered in connection with land traffic, while such bridges as that at Gray's Ferry should have a larger draw when rebuilt.

In order, however, to furnish the facts upon which my judgment is based, I give herewith a statement of the facts as far as I have been able to learn relating to all the bridges over navigable rivers in this district. Of the water-ways herein named, the Schuylkill River, Darby Creek, and the Thoroughfare back of the ocean between Cape May and Great Bay, New Jersey, are the only ones upon which works of improvement, surveys or examinations have been in progress during my charge, and consequently the information herein contained is, except in the cases above named, largely derived from the reports of examinations and surveys made by my predecessors.

RANCOCAS RIVER, NEW JERSEY.

This stream discharges into the Delaware River about 12 miles above Philadelphia. The project for its improvement proposes the formation of a low-water channel 6 feet deep from the mouth to Centreton, a distance of 7½ miles, and from there to Mount Holly, a distance of 5¾ miles, a channel 5 feet deep. The estimated cost was $82,000. Of this $20,000 have been appropriated and applied on the lower 4 miles of the river. The last appropriation was made in 1882.

In relation to the bridges crossing this stream Col. J. N. Macomb, Corps of Engineers, in his report under date of January 4, 1881, states:

> The turnpike bridge crossing the river about 1 mile above the mouth, is a double swing bridge with two openings of 45 feet each. Camden and Amboy Railroad Bridge is a single swing with an opening of 30 feet. The bridge is built at a bend in the river, and the pier stands at an angle with the currents, offering much difficulty to vessels passing up. Bridgeborough bridge is a draw sliding along the axis of the bridge. The width of opening is 30 feet. Centreton bridge is a single swing with an opening of 30 feet. The narrowness of these openings is now a considerable obstruction to river traffic, which the proposed improvement would render relatively much greater. (Report Chief of Engineers, 1881, page 798.)

FRANKFORD CREEK, PENNSYLVANIA.

This creek flows eastward through the northern part of the city of Philadelphia. An appropriation of $10,000 in 1882 was applied to dredging a 7-foot low-water channel from the mouth to Horseshoe Bend, near Bridge street, or for a distance of about half a mile.

The creek is crossed by five bridges, as follows: At the mouth, by a railroad bridge with draw-span openings of about 50 feet; one-half mile above the mouth, by the Bridge Street Highway Bridge, with a draw-span opening of about 33 feet; 1 mile above the mouth, by Orthodox Street Bridge, with draw-span openings of about 30 feet; 2¼ miles above the mouth, at about the head of navigation, by the Pennsylvania Railroad Bridge, and also by Fairmount Avenue Bridge; the last two are without draws. The grounds of the Frankford Arsenal are between the mouth of the creek and Bridge street.

The officers previously in charge of this district considered that if this creek was to be improved by the General Government, the two lower bridges should be rebuilt, so as to give an available clear opening of not less than 100 feet.

Frankford Creek, being entirely within the limits of Philadelphia, is being regulated by the city, and therefore for several years past no further appropriation has been recommended for its improvement.

PENSAUKEN CREEK, NEW JERSEY.

This creek discharges into the Delaware River about opposite the mouth of Frankford Creek. An examination of it was ordered by Congress in 1882, and the officer then in charge, after such examination, reported that it was not worthy of improvement.

The distance between the mouth and the head of navigation at Fork Landing is about 6 miles, and in this distance the creek is crossed by three bridges, all of which are without draws. The creek has some commerce, which, from the absence of draw-bridges, is restricted to canal-boats and scows. The high-water depth of the stream is from 5 to 6 feet. No appropriation has ever been made for its improvement.

SCHUYLKILL RIVER, PENNSYLVANIA.

The project for its improvement proposes the formation of an improved channel from its mouth to Chestnut Street Bridge, in the city of Philadelphia, a distance of 7¼ miles, from 24 to 18 feet deep. The estimated cost of this improvement was $500,000, of which $368,750 have been appropriated and applied.

Between the mouth and Chestnut Street Bridge the river is crossed by the following bridges: Penrose Ferry Highway Bridge, 1½ miles from mouth, with two draw-span openings, each of about 180 feet; Baltimore and Ohio Railroad Bridge, 5¼ miles from mouth, with a draw-span of two openings, each 75 feet wide; Philadelphia, Wilmington and Baltimore Railroad Bridge, combined with a highway bridge, known as the Gray's Ferry Bridge, about 5½ miles from mouth, with single draw-span of about 50 feet opening; Pennsylvania Railroad Bridge, 6¼ miles from mouth, with a draw-span of two openings, each about 75 feet wide; South-Street Bridge, 6¾ miles from mouth, with a draw-span of two openings, each 75 feet wide. Between Chestnut street and the Fairmount dam, a distance of about 1 mile, the river is crossed by the Chestnut Street Bridge, the Market Street Bridge, the Pennsylvania Railroad Bridge, and the Callowhill Street Bridge, all without draws.

WOODBURY CREEK, NEW JERSEY.

This creek discharges into the Delaware River about 8 miles below Philadelphia, or nearly opposite Fort Mifflin. It forms part of the southern boundary line of site for defenses at Red Bank, N. J. The project for its improvement proposed the formation, by dredging, of a high-water channel 8 feet deep between the mouth and the village of Woodbury, a distance of about 4 miles, at an estimated cost of $15,000.

In 1882 an appropriation of $5,000 was made for its improvement, but beyond a small expenditure for a survey the money has been withheld until the funds available will permit the formation of the proposed channel in a single season.

The creek is crossed by two bridges between its mouth and Woodbury, viz, at 1½ miles above the mouth by a highway bridge with a draw-span opening of 33 feet, and by the Crown Point Road Bridge, 1½ miles higher up, with a draw-span of 29 feet opening. The commercial statistics of 1882 indicate that 117 barges, 75 sloops, 18 schooners, and 66 steam vessels passed into the creek in that year.

MANTUA CREEK, NEW JERSEY.

This creek discharges into the Delaware River at a point about 10 miles below Philadelphia. The project for its improvement proposed, at an estimated cost of $35,000, the formation of a low-water channel 10 feet deep at the mouth, diminishing to 4 feet deep at the town of Mantua, situated about 11 miles above the mouth.

In 1882 an appropriation of $3,000 was made, but these funds have been withheld until further appropriation should be made. No further appropriations have been recommended of late years.

The creek is crossed by five bridges between the mouth and Mantua, as follows: A railroad bridge and a highway bridge at Paulsborough, with draw-span openings, respectively, of 35 and 40 feet; a railroad bridge and a highway bridge at Berkley without draw, and a highway bridge at Mantua, also without draw.

DARBY CREEK, PENNSYLVANIA.

This creek discharges into the Delaware River about 14 miles below Philadelphia. The river and harbor act of August 5, 1886, provided for its examination. No appropriation has been made for its improvement and the officer in charge in reporting thereon did not consider it worthy of improvement. Between its mouth and the village of Darby, a distance of about 7 miles, it is crossed by five bridges, the lower three of which are provided with draws. The remaining two permanent bridges are upon the upper half mile of the creek.

RIDLEY CREEK, PENNSYLVANIA.

This stream discharges into the Delaware River about 16 miles below Philadelphia. An examination of the creek was ordered by Congress in 1880. The officer in charge reported that private parties were engaged in its improvement. This work has been carried to completion to a point about 1 mile above the mouth.

At about half a mile above the mouth the creek is crossed by two railroad bridges, one of which is provided with a draw, the other is a permanent bridge. About 1 mile above the mouth is a highway bridge without a draw. Above this point there is navigation only at high water.

CHESTER CREEK, PENNSYLVANIA.

This stream discharges into the Delaware River at Chester, Pa. A survey of the creek was ordered in 1880 and in 1881 and 1882; $6,000 were appropriated for its improvement. This amount was expended in dredging a channel 7 feet deep between the mouth and the Third Street Bridge, a distance of about 1,600 feet. During the winter of 1882-'83 the local authorities of Chester placed a bridge across the creek at a point about 1,000 feet above the mouth. The stream is crossed by five Bridges within a distance of about 3,000 feet above the mouth. The lower of these bridges is provided with a draw-span of about 50 feet opening, the other four bridges are without draws.

RACCOON RIVER, NEW JERSEY.

This stream discharges into the Delaware River at a point about 18 miles below Philadelphia. The project for its improvement proposed, at an estimated cost of $18,000, the formation of a channel from 3 to 4 feet deep at low water from the mouth to Swedesborough, a distance of about 9½ miles.

In 1882 an appropriation of $3,000 was made, but beyond the cost of an examination no expenditures have been made, and the balance is held to await further appropriations.

The river is crossed by four bridges, two of which are located at Bridgeport and two at Swedesborough; the former are provided with draw-spans, but the latter are without them.

SALEM RIVER, NEW JERSEY.

This stream discharges into the Delaware River near Fort Delaware, and also by means of an artificial channel at a point about 10 miles above the natural mouth. The original project proposed the dredging of a channel 8 feet deep at low water through the bar at its mouth and the deepening of the channel through the shoals between the mouth and Hoxie's Landing; $14,500 have been appropriated for its improvement, of which about $13,000 have been expended.

There are four bridges below Sharptown, two of which cross the natural river and two over the artificial channel previously alluded to. These bridges are all provided with draws.

NORTH BRANCH OF THE SUSQUEHANNA RIVER, PENNSYLVANIA.

This part of the Susquehanna River is understood to extend from Wilkes Barre to the north boundary line of Pennsylvania, a distance of about 100 miles. No general project for the comprehensive improvement of the river has ever been adopted, but the appropriations aggregating $45,000, have been applied to obtaining a low-water channel 3 or 4 feet deep through the worst obstructions. The commerce of the river is trifling and mainly confined to rafts. No further apppropriations have been recommended for its improvement for several years past.

The river is crossed by a number of railroad and highway bridges, which are presumably without draws. The reports which are available do not give information as to the number, location, and character of these bridges.

THOROUGHFARE RUNNING BACK OF THE OCEAN BETWEEN CAPE MAY AND GREAT BAY NORTH OF ATLANTIC CITY, NEW JERSEY.

The river and harbor act of August 5, 1886, provided for the examination of this water route. No appropriation has ever been made for its improvement.

Between Cape May City and Great Bay, a distance of about 63 miles, the Thoroughfare is crossed by nine bridges, as follows: Highway bridge near Holly Beach; railroad bridge near Anglesea; highway bridge near Sea Isle City; railroad bridge near Sea Isle City; highway bridge near Ocean City; highway bridge near Atlantic City, and three railroad bridges near Atlantic City. All of these bridges are provided with draws with from 20 to 50 feet openings.

It is not known that any of the foregoing bridges were constructed under any provisions or limitations imposed by Congress or the Secretary of War, but they have probably been erected under State or local authority.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. WILLIAM F. SMITH, UNITED STATES AGENT.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., January 10, 1887.

GENERAL: In compliance with instructions contained in General Order No. 7, Headquarters Corps of Engineers, United States Army, Washington, D. C., November 30, 1886, inviting attention to section 4 of the river and harbor act approved August 5, 1886, I have the honor to submit a copy of a report, made under my direction by Mr. Charles Humphreys, assistant engineer, containing all the information which could be obtained at this time relating to bridges that do or will interfere with free and safe navigation of the rivers and harbors in my district.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. CHARLES HUMPHREYS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., January 6, 1887.

GENERAL: In compliance with your verbal instructions I have the honor to make the following report on bridges crossing navigable streams in your district:

MAURICE RIVER, NEW JERSEY.

At Millville there is a pivot draw-bridge of two spans of 41 feet each in the clear, only one span available for navigation; this span can be widened to 45 feet by removing one sidewalk of the draw.

In case side-wheel boats should be put on this river they would not come above this bridge. This bridge is not therefore considered an obstruction at present. The structure is iron, in good working order belongs to Cumberland County, New Jersey.

At Mauricetown there is a rolling draw-bridge of one span of 58 feet 4 inches in the clear; this is a wooden structure. Vessels and steamers pass this bridge at flood tide without special difficulty, but going down stream at ebb tide are carried against the right-hand channel-pier. To avoid this danger a line of fender-piling 250 feet long should be built, as shown by red line on sketch transmitted herewith. This bridge belongs to Cumberland County. There is about 5 feet on the bar at mean low water; the tide rises from 5.5 to 6 feet.

HARBOR AT WILMINGTON, DELAWARE.

At Third street there is a draw-bridge opened and shut by hand. The commerce of this harbor demands that this bridge should be maneuvered by steam as is done at Market street, the next bridge above. This bridge belongs to New Castle County, Delaware.

BROADKILN RIVER, DELAWARE.

At "Drawbridge," Del., there is a draw-bridge of two spans of 38.5 feet and 37.9 feet in the clear. The present project calls for 40 feet width of channel. This bridge is not considered a serious obstacle at present.

BROAD CREEK, DELAWARE.

The Delaware Division of Philadelphia, Wilmington and Baltimore Railroad crosses this stream 2,000 feet below the turning-basin, the head of navigation, on a wooden bridge without a draw. The channel-span of this structure is 32 feet wide in the clear, with 20 feet headway above mean low water. The present project calls for 50 feet width of channel. This bridge is a serious obstruction. It should have a draw-span of 56 feet in the clear to permit the passage of side-wheel boats. About three-fourths of the commerce of this stream will pass this bridge when the present project is completed. The present 200-ton propeller-boat has to lower her pilot-house and smoke-stack, and all vessels have to lower their masts, before passing.

About 200 feet below the turning-basin there is a county bridge with two draw-spans of 30 feet and 29.3 feet. This bridge answers the needs of present commerce, but it will probably have to be widened to 56 feet when the present project is completed. It is not considered a serious obstruction at present.

SAINT JONES RIVER, DELAWARE.

There is a draw-bridge at Barker's Landing with 34 feet clear width of span. This is a wooden structure, and is so much decayed that it will probably be necessary to build a new bridge in a year or two. There is no tender employed, and the steamers and vessels have to make landings above and below this bridge to open and shut the draw. This bridge is a serious obstruction. The bar at the mouth of this stream will probably require two long jetties, in order to deepen it sufficiently to run a successful propeller-boat; but the river has been navigated by a double-engine side-wheel boat of light draught.

In case the bar at the mouth is not improved, it will be necessary to resort to side-wheel boats; for this reason these draws should be 56 feet in the clear. The draw-bridge at Lebanon has a clear span of 32 feet; this span should be widened to 50 feet in the clear and provided with a tender. All passing boats and vessels have to do their own maneuvering at present. Both of these bridges could be widened to 38 feet at small expense. The width of 38 feet is sufficient for sailing vessels and propellers. There is about one foot depth on the bar at mean low water. The tide rises about 5 feet.

DUCK CREEK, DELAWARE.

There is a pivot draw-bridge about 7 miles below Smyrna, clear span 38 feet. This bridge is in good order and provided with a tender. Although this bridge excludes side-wheel boats it is not considered a serious obstruction at present, for the reason that the commerce of the stream is carried in vessels and steamers not over 30 feet wide. These vessels and steamers have to wait for the tide to cross the bar at the mouth of Duck Creek. In case this bar is not deepened it may be necessary to use side-wheel boats. This would require a width of draw of 56 feet. This is a county bridge. There is about 3.5 to 4 feet on the bar at mean low water. The tide rises about 5.7 feet.

SUSQUEHANNA RIVER, MARYLAND.

McClenahan & Bro., Port Deposit, Md., write as follows:

* * * "The Baltimore and Ohio Railroad has a bridge for the use of its Philadelphia branch, crossing the Susquehanna at Watson's Island. This bridge is over a mile

in length, without any draw, and has 7 piers in the river of heavy masonry, with the ends up the river rounded instead of pointed, and consequently offering considerable obstruction to the passage of ice.

"It has two channel-spans each 90 feet above mean tide, but forms a serious obstruction to the free navigation of the river, inasmuch as schooners carrying 125 tons and upwards, in passing up and down the river to and from Port Deposit and Lapidum, are obliged to 'strike' their topmasts in order to pass under the bridge.

"A large portion of the tonnage coming up the river to the above places is from Virginia and North Carolina, and requires the use of sea-going vessels; but now an increase in freight has become necessary to induce the captains to load, because of the trouble, expense, and detention in striking their topmasts at this bridge.

"When the channel-spans of this bridge were being put up, temporary piling was driven in the channel of the river, on which cribs filled with stone were placed. It is now alleged that the stones from these cribs were allowed to drop into the channel. Only part of the piles were taken out. It is such an important matter that I would suggest an investigation of it. There is another matter to which I would invite your attention, and that is the present gorged condition of the ice in this river and the causes of it. No more opportune time than the present could be afforded for viewing it. There is no doubt but what the piers of the Baltimore and Ohio Railroad Bridge as constructed are one of the main causes."

CHOPTANK RIVER, MARYLAND.

There is a pivot draw-bridge at Denton belonging to the county. It has two spans available for navigation of 41 and 42 feet each in the clear. These spans can be widened to 47 feet at small expense.

The present project of improvement calls for 75 feet channel width above this bridge. This bridge is considered an obstruction and should be widened to 56 feet in the clear.

At Dover there is a county bridge with draw-span of about 56 feet in the clear. This structure is not considered a serious obstruction at present, although I am informed that the present side-wheel boats have only 18 inches clearance.

POCOMOKE RIVER, MARYLAND.

Capt. Willard Thomson, superintendent Eastern Shore Steamboat Company, writes: "There are two bridges on said river, one just above and one just below Pocomoke City. The bridge just below the town is a railroad-bridge in good condition, with draw 56 feet wide. The bridge above the town is a foot and carriage bridge, and is in very bad condition, with draw 50 feet wide. The draw of this bridge should be made 56 feet wide, and the bridge thoroughly overhauled. As it is now the draw is troublesome and dangerous to pass through. The bridge is in a very dilapidated condition generally."

CAMBRIDGE HARBOR, MARYLAND.

[Under examination.]

There is a draw-bridge with two spans of 28 feet each between the upper and lower harbor. This bridge is not a serious obstruction at present, but if the upper harbor is improved by the Government, as is desired by the citizens at present, the draw should be increased to 56 feet.

Very respectfully, your obedient servant,

CHAS. HUMPHREYS,
Assistant Engineer.

General WM. F. SMITH,
United States Agent.

SUPPLEMENTARY REPORT OF MR. WILLIAM F. SMITH, UNITED STATES AGENT.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., January 11, 1887.

GENERAL: In addition to the bridges reported on the 10th instant, in compliance with General Order No. 7, Headquarters Corps of En gineers, 1886, that do or will interfere with free and safe navigation, I have the honor to submit the following:

INLAND WATER-WAY FROM CHINCOTEAGUE BAY, VIRGINIA, TO DELAWARE, AT OR NEAR LEWES, DELAWARE.

At Ocean City the Wicomico and Pocomoke Railroad cross Chincoteague Bay on a draw-bridge about 26 feet clear span. At Fenwick's Island there is a bridge over "the Narrows" without a draw.

When navigation is opened between Little Assawoman Bay and Indian River Bay, which is a part of the route of the "inland water-way from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Delaware," these bridges will be obstructions to navigation until there is a draw of 56 feet clear span placed in each of them.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL PETER C. HAINS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., December 16, 1886.

SIR: In reply to instructions contained in General Orders No. 7, current series, Headquarters Corps of Engineers, United States Army, I submit herewith copies of reports made by me under date of November 5, 1884, on the bridge known as the "Aqueduct," and under date of September 10, 1884, on the structure known as the "Long Bridge."*

The circumstances detailed in these reports have not altered since the dates thereof, and the structures "interfere with free and safe navigation" to the same extent to-day that they did then.

Very respectfully, your obedient servant,

PETER C. HAINS,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., January 27, 1887.

GENERAL: I had the honor January 6, 1887, to make a report in compliance with the instructions contained in General Order No. 7, from your headquarters, series of 1886, in which a special communication relative to Elk River, West Virginia, was promised. Since that date I have been to Charleston.

---

*These reports are omitted, having already been transmitted to Congress, to comply with the requirements of the river and harbor act of July 5, 1884, and printed as Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

Reference is requested to the report of October 30, 1884, made in considerable detail, which was printed and may be found in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session, and to the report of Mr. Scott. See page 1599, Appendix CC, Annual Report of Chief of Engineers, 1886. The situation is much the same as then explained, with the following additions:

A new bridge has been built on the Elk River at Charleston, which has a height somewhat greater than the others. It was, like them, built under State law, and is too low in view of the possibilities of the future increase of navigation, especially as the importance of that portion of Elk River has been enhanced by the greater depth of water caused by the Dam No. 6, on the Great Kanawha below it. The bridges are not, however, obstructions to navigation at this time.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

To the CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. S. T. ABERT, UNITED STATES AGENT.

UNITED STATES ENGINEER OFFICE,
Washington, D. C., December 28, 1886.

GENERAL: In compliance with the instructions contained in General Orders No. 7, Headquarters Corps of Engineers, United States Army, dated November 30, 1886, requiring me to report "whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation," I have the honor to submit the following statement:

It is reported that the railroad bridge under the control of the Richmond and Danville Railway Company, built across the Pamunky River, Virginia, at White House, about 30 miles above West Point, interferes with free and safe navigation. The complaint made is that the channel through the draw is too narrow, and that the bridge is not perpendicular to the line of the current. The available width of opening is reported to be 45 feet. Vessels passing through the draw are swept against one or the other side of the opening, and are injured by the bolts and timbers of the fenders.

A similar objection has been made to a bridge built by the Alexandria and Fredericksburg Railroad over the Neabsco Creek, Virginia. This creek enters the Potomac River about 28 miles below Washington, D. C.

I have the honor to be, very respectfully, your obedient servant,

S. T. ABERT,
United States Agent.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., January 24, 1887.

GENERAL: In accordance with General Order No. 7, Headquarters Corps of Engineers, United States Army, series 1886, relative to section 4 of the river and harbor act of August 5, 1886, I have the honor to report as follows upon bridges, &c., in this district which interfere with free and safe navigation.

On October 31, 1884, I made a report on this subject which has been transmitted to Congress and printed in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

On April 20, 1885, I made another report on the Norfolk and Western Railroad bridges over the eastern and southern branches of the Elizabeth River (copy herewith). This report was submitted by you, through the Secretary of War, to the Attorney-General of the United States, and on June 16, 1885, the latter gave an opinion on the same (copy herewith), of which the following is an extract:

* * * * * * *

> Upon consideration, I am of opinion that the facts set forth in the papers are not in themselves sufficient to authorize a judicial proceeding against said company *in behalf of the United States*, and that for this purpose authority from Congress is needed.

* * * * * * *

In my communications to you of May 8 and 25 1885 (copies herewith), I reported that these bridges had been modified accordingly. * * *

It is understood that no further action has been taken regarding the foregoing. The above covers all facts within my knowledge and all information attainable by me relative to this subject.

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS, TO THE CHIEF OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., April 20, 1885.

GENERAL: I have the honor to state as follows: On the 11th instant I reported to you that the Norfolk and Western Railroad Company proposed to make certain modifications of its bridges over the Eastern and Southern branches of the Elizabeth River, Virginia; that I understood that the company's general superintendent intended to see you personally regarding the matter, and that I was preparing a report on the same, which report is now respectfully submitted, as follows:

In December last the United States Advisory Board to the Board of Harbor Commissioners of Norfolk and Portsmouth, Va., received from the said Board of Harbor Commissioners a communication, dated December 16 last, transmitting copy of a letter dated December 15 last (copy herewith), from the Engineer of the Norfolk and Western Railroad, requesting permission to strengthen the company's bridge over the Eastern Branch of the Elizabeth River by trestling, &c. The Board of Harbor Commissioners also requested the opinion of the Advisory Board regarding same. The Advisory Board gave an opinion, January 7 last (copy herewith), adverse to the request.

Later the Advisory Board received an invitation from the Board of Harbor Commissioners, dated the 19th ultimo (copy herewith), to meet the Board of Harbor Commissioners, the Superintendent, and also the Engineer of the Norfolk and Western Railroad Company, on the 23d ultimo, at which time the last two were to submit to the Board of Harbor Commissioners an application (copy herewith, dated the 23d ultimo) for permission to drive piles for strengthening the Norfolk and Western Railroad Company's bridges over the Eastern and Southern branches.

The Advisory Board accepted the invitation, and I of course accompanied the Board, being a member.

The plans (three copies herewith) of the company were submitted and explained at the meeting by the company's aforesaid officers. My views were asked thereon, and I gave them substantially as follows: I stated that the said communication of the Advisory Board dated January 7 last still applied to the plans proposed for the Eastern Branch Bridge, and that it also applied generally to that proposed for the Southern Branch Bridge; that the solid approaches to each bridge materially contracted the water-way; that both bridges crossed the channel obliquely, and that consequently the piers offered a greater obstruction to the currents than if at right angles. I called attention to the bar that had reformed just below the Eastern Branch Bridge since the Government had dredged that locality to a depth of 25 feet at mean low water in 1883, stating that it was due in a great measure to the faulty construction of the bridge. I also referred to the additional pier (larger than the others) proposed for a new draw, for which no compensation is to be made as regards water-way, and objected to the width of the proposed draw as being too narrow. Finally, I stated that in my opinion the company should apply to the Honorable the Secretary of War for permission to modify the bridges, and not to the Board of Harbor Commissioners, as the latter had no jurisdiction in the matter. In support of this I cited the act constituting the Board (copy herewith), which does not refer to bridges, stated the course pursued in relation to other bridges, &c.

However, the Board of Harbor Commissioners did grant the permission by letter of the 24th ultimo (copy herewith), which was accepted by the company by letter of the 28th ultimo (copy herewith).

Aside from the foregoing I have not been consulted at all by the company. I obtained the aforesaid copies of the plans by applying to the company's Chief Engineer for them, and Mr. W. H. Peters has furnished me with the foregoing copies of the correspondence between the Board of Harbor Commissioners, of which he is a member, and the officials of the railroad company. By permission of the Advisory Board I have had free access to the records of the Board.

A copy of my report to you, dated October 31 last, relative to these bridges, with map accompanying, is transmitted herewith. I also submit with this a map of the site of the Eastern Branch Bridge, and a section of the river at same, from my survey, just completed.

The following table, which is self-explanatory, gives data relative to the Eastern Branch Bridge:

	Authority, Captain Hinman.	Authority, W. W. Coe.
Total length .... feet..	664¾	669¼
Width of draw .... do...	41 5/12	43½
Total area of water-way through bridges at mean low water...... square feet..	11,135	11,138
Total area of water-way through draw at mean low water .... do...	435	423

It will be observed that the shape of my section of the draw differs materially from Mr. Coe's, as well as the sections near each pier.

The following gives the areas of the cross-sections of the water-way at various points on the Eastern Branch, shown on the accompanying map, as well as the area of the oblique section at the Eastern Branch Bridge:

	Square feet.
Cross-section at A B	11,900
Cross-section at G H	14,250
Section at Eastern Branch Bridge	11,235
Cross-section at C D	13,410
Cross-section at E F	22,050

It will be noticed that the section at the bridge is smaller than any of the others, although oblique.

In all probability the valuable area just above the Eastern Branch Bridge will sometime be dredged to correspond with that below by parties interested in it, and the channel at the bridge should be made equally as good.

It is evident that the company's plans are not strictly temporary. No businesslike guarantee is given that new structures will ever be built.

The Board of Harbor Commissioners was created *solely* for "the preservation and improvement of the harbor." It is not thought that the Board's action in this respect is in that direction.

In conclusion I have to report that, in view of the foregoing, I am of the opinion that the said plans should not be executed, and respectfully request your instructions as to the course to be pursued by me if the company attempts to carry them out under the authority granted by the Board of Harbor Commissioners.

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.
(Through Lieut. Col. William P. Craighill, Corps of Engineers, U. S. A.)

[First indorsement.]

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., April 23, 1885.

Respectfully forwarded to the Chief of Engineers.

The importance of the Norfolk and Western Railroad to Norfolk is such as to justify a reasonable concession to that company in the way of allowing a temporary inconvenience to navigation while they are strengthening their bridges, if the law allows it, and no undue obstruction to navigation be permitted. It is doubtful whether the jurisdiction of the Harbor Board extends to the bridges in question. The draws were badly located in the beginning and without sufficient regard to the rights of navigators. The best solution of the difficulty is a permanent and proper rearrangement of the bridges at once, taking into consideration all the interests involved. The time asked by the railroad for their temporary makeshifts in the way of trestling seems too long, even if any concession in that direction be made. The question of the jurisdiction of the Harbor Board in this matter and of the power and duty of the Secretary of War or other officials of the United States are legal in character, and no opinion with reference to them is expressed by me.

WM. P. CRAIGHILL,
Lieut. Col. of Engineers

LETTER OF CHIEF ENGINEER OF THE NORFOLK AND WESTERN RAILROAD COMPANY, TO THE PRESIDENT OF BOARD OF HARBOR COMMISSIONERS, OF NORFOLK, VIRGINIA.

NORFOLK AND WESTERN RAILROAD COMPANY,
OFFICE SUPERINTENDENT EASTERN DIVISION,
Norfolk, Va., December 15, 1884.

DEAR SIR: We have in contemplation the use of a considerably heavier type of engines on the eastern division (Norfolk to Lynchburg) of our line than are at present in use, and this necessitates the strengthening of some and the entire removal of other of our bridges. This work is now in hand, and we desire to push it vigorously next summer in order to avail ourselves of the heavier engines for our fall traffic. Our plans contemplate the temporary trestling of our bridge across the East Branch of the Elizabeth River, until such time as we can mature our plans and arrange to put in a new structure. We would respectfully ask permission to temporarily trestle this structure in spans of 25 feet, said trestles to remain for a period of four years, except for such portions as may have been replaced by a new structure, which will be built subject to your approval.

Very respectfully, yours,

W. W. COE,
Chief Engineer.

MR. CHAS. REID,
President Board Harbor Commissioners,
Norfolk, Va.

LETTER OF UNITED STATES ADVISORY BOARD TO THE PRESIDENT OF BOARD OF HARBOR COMMISSIONERS OF NORFOLK, VIRGINIA.

NORFOLK, VA., *January* 7, 1885.

DEAR SIR: We have to acknowledge the receipt of your communication of the 16th ultimo, transmitting copy of a communication dated the 15th ultimo, from Mr. W. W. Coe, Chief Engineer Norfolk and Western Railroad Company, relative to proposed modification of the company's bridge over the Eastern Branch by placing trestles under it in spans of 25 feet, and asking our opinion "as to the effect of additional structures at this point upon navigation and upon the flow of currents there."

As neither plan of the bridge nor map of its site accompanied Mr. Coe's letter, our chairman requested of him more definite information. To date he has only furnished us that contained in his letters of the 20th ultimo and 3d instant, respectively (copies herewith), which modifies his first plan, as will be evident to you. However, it is understood that this bridge, from abutment to abutment (exclusive), is about 640 feet in length. Deducting from this the three piers, presumed to be 10 feet each, leaves 610 feet for total clear water-way. The clear water-way, exclusive of the draw space, is about 560 feet, which it is probably proposed to divide into twelve spans of from 45 to 50 feet each, supported by nine trestles 4 feet each, making 36 feet *additional* obstruction in all, or about 6 per cent. of the *total* clear water-way, *width* only considered.

The structures proposed would probably be obstructions for some crafts that now pass under the bridge and not through the draw. They would also act on the current and change the regimen of the river to the detriment of navigation.

This bridge is already an obstruction to navigation, the draw being improperly placed and not wide enough nor deep enough. Of course a suitable draw should be built without further delay, and now is the time to do it.

In view of the foregoing, this Board advises you not to consent to the modification proposed by the company for this bridge.

Yours truly,

W. T. TRUXTUN,
Commodore, United States Navy,
and Chairman of the Board.
F. A. HINMAN,
Captain of Engineers, U. S. A.
C. O. BOUTELLE,
Assistant, United States Coast and Geodetic Survey.

Mr. CHAS. REID,
President Board Harbor Commissioners, Norfolk, Va.

LETTER OF THE CHIEF ENGINEER OF THE NORFOLK AND WESTERN RAILROAD COMPANY TO THE CHAIRMAN UNITED STATES ADVISORY BOARD.

NORFOLK AND WESTERN RAILROAD COMPANY,
Roanoke, Roanoke County, Virginia, January 3, 1885.

DEAR SIR: I send herewith suggestions for strengthening our bridge across East Branch, Elizabeth River, by temporary trestling. Please note that in the plans suggested the bridge is supported by piles at intervals of 50 feet, and that the clear span between piles supports would be 46 feet.

We would like at an early date to make a practical test of the plans submitted by driving one pile at the center of each span, excepting, of course, the draw-span; allowing the same to remain not longer than two weeks, unless permission should in the mean while be granted us to proceed with the work of supporting the bridge in the manner indicated.

I would most respectfully ask that permission be granted us to make the above-mentioned test at an early date.

Yours very truly,

W. W. COE,
Chief Engineer.

W. T. TRUXTUN,
Commodore, U. S. N., Chairman Advisory Board,
Norfolk and Portsmouth Harbor Commissioners, Norfolk, Va.

LETTER OF THE GENERAL SUPERINTENDENT OF THE NORFOLK AND WESTERN RAILROAD TO THE PRESIDENT OF THE BOARD OF HARBOR COMMISSIONERS OF NORFOLK, VIRGINIA.

NORFOLK AND WESTERN RAILROAD COMPANY,
Roanoke, Roanoke County, Virginia, March 26, 1885.

DEAR SIR: The putting into operation of the coal pier at Lambert's Point, and the large quantities of coal conseqently to be carried over our eastern division to that point through Norfolk, compels this company to take immediate steps to provide new and heavier motive power to supply the place of the old and lighter equipment, that is now nearly worn out. Before this can be done it is necessary for the company to rebuild or strengthen a number of its bridges. The most important of these are the bridges over the East and South branches of Elizabeth River.

The company has prepared plans for the renewal of these bridges with structures adapted to the heavier class of engines. A plan of the proposed new structure over the Eastern Branch is submitted herewith.

Over the South Branch we propose to replace the present spans with lattice-girders on the same iron columns.

In consequence of the company having to expend large sums of money at other points on the line in renewing bridges that cannot be temporarily strengthened, it will be impracticable to renew the Elizabeth River Bridges at this time.

It is our intention to complete South Branch Bridge in 1886, and the Eastern Branch Bridge in 1887.

The purpose of this application is to obtain from your honorable Board permission to support the bridge over the Eastern Branch of Elizabeth River with pile trestles in spans of 50 feet centers; and the bridges over the South Branch of Elizabeth River with spans of 12½ feet centers, as per plans submitted.

The granting of the privilege to begin this work at once will enable this company to make immediate arrangements for heavier locomotives, so that this very heavy coal traffic to your city can be handled with advantage and economy.

Should your honorable Board refuse this application the coal traffic will be curtailed, as it will be impracticable to haul this class of freight from Pocahontas to Norfolk and compete with other coal ports.

Having the interests of your city and port in view, I trust you will see fit to take favorable action.

Respectfully,

JOSEPH H. SANDS,
General Superintendent.

CHARLES REID, Esq.,
President Board of Harbor Commissioners, Norfolk, Va.

LETTER OF THE BOARD OF HARBOR COMMISSIONERS OF NORFOLK, VIRGINIA, TO THE GENERAL SUPERINTENDENT OF THE NORFOLK AND WESTERN RAILROAD.

HARBOR COMMISSIONERS' OFFICE,
Norfolk, Va., March 24, 1885.

SIR: Your letter of 23d instant, asking permission to strengthen the Norfolk and Western Railroad bridges across the Southern and Eastern branches of the Elizabeth River by driving piles as temporary support to those bridges, was laid before the Board at its meeting yesterday, and duly considered.

In accordance with the action of the Board, permission is hereby granted the Norfolk and Western Railroad Company to drive sundry piles, as indicated and shown in the drawings submitted, to support and strengthen the present bridges until the same are removed, repaired, or rebuilt, upon the special pledge and condition that all piles driven under this permit shall be fully and entirely removed before the end of the year 1887.

Your offer to guarantee that the depth of water now existing in the eastern branch shall be maintained at the company's expense so long as the supporting piles remain, provided it be shown to the satisfaction of the Board that the depth of water there has been lessened by reason of the piles now authorized to be driven, is accepted as a condition of this permit. The present draw is complained of by various persons, and we desire that a new draw be placed nearer the middle of the river. The location laid down in one of your drawings for the proposed draw will be acceptable to the Board if it be not less than 60 feet wide, for which purpose an additional stone pier will become necessary, and the same is hereby authorized to be built.

Very respectfully,

CHARLES REID,
President.

JOSEPH H. SANDS, Esq.,
General Superintendent Norfolk and Western Railroad Company,
Roanoke, Va.

LETTER OF THE GENERAL SUPERINTENDENT OF THE NORFOLK AND WESTERN RAILROAD TO THE PRESIDENT OF THE BOARD OF HARBOR COMMISSIONERS OF NORFOLK, VIRGINIA.

NORFOLK AND WESTERN RAILROAD COMPANY,
Roanoke, Va., March 28, 1885.

DEAR SIR: I beg leave to acknowledge receipt of your favor of the 24th instant, in reply to mine of the 23d, in the matter of strengthening the bridges across the Southern and Eastern branches of Elizabeth River.

The conditions attached to this permission are entirely satisfactory to this company and are accepted.

I would be very much obliged if you would make an arrangement by which the depth of water as at present exists be ascertained, so that we will know exactly what we may have to expect.

In conclusion, I beg to extend to yourself and members of the Board my appreciation of their courtesy in connection with the above matter.

Yours truly,

JOSEPH H. SANDS,
General Superintendent.

CHARLES REID, Esq.,
President of the Board of Harbor Commissioners,
Norfolk, Va.

LETTER OF THE CHIEF OF ENGINEERS TO THE SECRETARY OF WAR.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., May 1, 1885.

SIR: The river and harbor act of July 5, 1884, imposes certain duties upon the Secretary of War, and in section 2 provides that—

"He shall also report whether any bridges, causeways, or structures now erected, or in process of erection, do or will interfere with free and safe navigation, and if they do or will so interfere to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstructions."

The reports upon this clause were not received in time for submission to Congress at its last session, but are now in preparation and will be submitted to the Secretary of War in time for the action of the next Congress. Among the reports received is one from Capt. F. A. Hinman, Corps of Engineers, reporting that the bridges of the Norfolk and Western Railroad Company crossing the Southern and Eastern branches of the Elizabeth River at Norfolk, Va., obstruct the navigation of that river, and recommending certain modifications to comply with the requirements of the act. In the meantime, as will appear from the accompanying report of Captain Hinman, dated April 20, the Norfolk and Western Railroad Company propose to enter upon the work of strengthening their bridges (with the ultimate view of modifying them) in such a way as will add further obstructions to navigation, and while as stated by Lieut. Col. W. P. Craighill, Corps of Engineers, in forwarding Captain Hinman's report, "the importance of the Norfolk and Western Railroad to Norfolk is such as to justify a reasonable concession to that company in the way of allowing a temporary inconvenience to navigation while they are strengthening their bridges, if the law allows it, and no undue obstruction to navigation be permitted," it is thought that the subject is of sufficient importance to warrant action by the United States authorities, if such action can be legally taken. The report required by the section of the river and harbor act above quoted not having been submitted to Congress, it is doubtful whether action be taken under it in the absence of further or of any other legislation on the subject, and the matter is accordingly submitted for consideration and such instructions as may be deemed advisable.

Very respectfully, your obedient servant,

JOHN NEWTON,
Chief of Engineers,
Brig. and Bvt. Maj. Gen.

Hon. WM. C. ENDICOTT,
Secretary of War.

LETTER OF THE SECRETARY OF WAR TO THE ATTORNEY-GENERAL.

WAR DEPARTMENT,
Washington City, May 11, 1885.

SIR: I have the honor to invite your attention to the inclosed letter dated the 1st instant, from the Chief of Engineers, and accompanying papers, from which it will be seen that the bridges of the Norfolk and Western Railroad Company crossing the Southern and Eastern branches of the Elizabeth River at Norfolk, Va., obstruct the navigation of that river. It will also be seen from the report of Capt. F. A. Hinman, Corps of Engineers, inclosed herewith, that the said company propose to enter upon the work of strengthening their bridges (with the ultimate view of modifying them) in such a way as will add further obstruction to navigation.

It is thought by the Chief of Engineers that the subject is of sufficient importance to warrant action by the United States authorities, if such action can be legally taken. I beg, therefore, to request that you will take such action in the case as may be necessary to protect the interests of the Government.

Very respectfully, your obedient servant,

WM. C. ENDICOTT,
Secretary of War.

The Honorable the ATTORNEY-GENERAL.

LETTER OF THE ATTORNEY-GENERAL TO THE SECRETARY OF WAR.

DEPARTMENT OF JUSTICE,
Washington, June 16, 1885.

SIR: I return herewith the papers which accompanied your letter of the 11th ultimo, in relation to the bridges of the Norfolk and Western Railroad Company across the Southern and Eastern branches of Elizabeth River at Norfolk, Va.

It appears by these papers that, in the view of officers of Engineers' Department, those bridges are already an obstruction to navigation, and that the work of strengthening them, as proposed by said company, will add to the obstruction. This matter is thought to be of sufficient importance to warrant action by the United States authorities, if such action can be legally taken.

Upon consideration, I am of opinion that the facts set forth in the papers are not in themselves sufficient to authorize a judicial proceeding against said company *in behalf of the United States*, and that for this purpose authority from Congress is needed. In connection with this point, I beg to refer to my opinion of May 1, 1885, in the matter of the construction of a railroad bridge across the Mississippi at Saint Paul, wherein the subject of authority of officers of the Government to institute proceedings in its behalf in cases like the present is fully examined.

I suggest that the proper course to take in the present case is indicated by the following provision in section 2 of the act of July 5, 1884, chapter 229: "He (the Secretary of War) shall also report (to Congress) whether any bridges, causeways, or structures, now erected or in process of erection, do or will interfere with free and safe navigation, and if they do or will so interfere, to report the best mode of altering or constructing such bridges or causeways so as to prevent any such obstructions."

I am, sir, very respectfully,

A. H. GARLAND,
Attorney-General.

The SECRETARY OF WAR.

LETTERS OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS, TO THE CHIEF OF ENGINEERS.

1.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., May 8, 1885.

GENERAL: I have the honor to report that a pier has been placed under the center of each of the six spans (other than the draw-span) of the Norfolk and Western Railroad Company's bridge over the Southern Branch of the Elizabeth River, Virginia, composed of four piles connected together about as shown on plan of same sent you with my report thereon of the 20th ultimo.

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

2.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., May 25, 1885.

GENERAL: I have the honor to report that three piers have been placed under each of the three spans (other than the draw-span) of the Norfolk and Western Railroad

Company's bridge over the Eastern Branch of the Elizabeth River, Virginia, each composed of four piles connected together about as shown on plan of same sent you with my report thereon of the 20th ultimo.

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN W. H. BIXBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Wilmington, N. C., December 18, 1886.

SIR: In accordance with the instructions of General Orders No. 7, Headquarters Corps of Engineers, United States Army, Washington, D. C., 30th November, 1886, I have to submit herewith a report* upon the bridges, causeways, &c., which interfere with the free and safe navigation of the rivers within the district in my present charge,

Very respectfully, your obedient servant,

W. H. BIXBY,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, January 22, 1887.

GENERAL: In conformity with General Orders No. 7, Headquarters Corps of Engineers, series 1886, I have the honor to submit the following report upon "bridges, causeways, or structures now erected, or in process of erection," that "do or will interfere with free and safe navigation" within the district in my charge.

ASHLEY RIVER, SOUTH CAROLINA.

The bridge recently built across this river at Charleston has a pivot-draw of two openings of 75.6 feet and 75.8 feet, respectively. It is located near the west bank of the river.

An obstruction is formed here to the extent that some difficulty is experienced in passing through when tidal currents are strong. It is probable that the passage would be easier if the draw was nearer the center of the river.

EDISTO RIVER, SOUTH CAROLINA.

(1) The bridge of the South Carolina Railroad near Branchville has no draw. It is a single fixed span wooden bridge. It forms no obstruction at present while navigation is confined to rafting, but will probably do so when the Edisto shall have been improved for light-draught steamers, as contemplated by the existing project.

---

* These reports are omitted, having already been transmitted to Congress, December 28, 1885, to comply with the requirements of the river and harbor act of July 5, 1884, and printed in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

(2) Three country-road bridges, Cooner's, Richardson's, and Canaday's, cross the stream at reaches to be improved for steamboat navigation. When this improvement shall have been accomplished they will obstruct the passage of steamers. At present they do not interfere with raft navigation.

(3) The Charleston and Savannah Railroad Bridge at Jacksonborough has a pivot draw, one opening 48 feet wide. The bottom chord is at an elevation of 8 feet above high-water mark. It is a new structure.

The bridge itself does not interfere with navigation, but the passage for rafts as well as the draw-opening is obstructed by piles of the former bridge, which were not cut off low enough, and which also cause an accumulation of drift-logs. The railroad company should be required to remove these piles.

SALKIEHATCHIE RIVER, SOUTH CAROLINA.

(1) Toby's Bluff Bridge is too low, and one bent is so much in the channel as to interfere with raft navigation.

(2) The Charleston and Savannah Railroad Bridge has no draw. The opening is 38 feet. The river is navigable for several miles higher up for light-draught steamers; but their passage is obstructed by the bridge.

SAVANNAH RIVER, GEORGIA.

The bridge of the Port Royal Railroad, about 4 miles below Augusta, Ga., gives some trouble to steamboats at high stages of the river, although provided with a draw about 90 feet wide. The trouble is caused by the structure making an angle of about 75 degrees with the current, the piers being perpendicular to the axis of the bridge. The draw is not considered to be located near enough to the South Carolina bank of the river to afford the best passage for steamboats.

ALTAMAHA RIVER, GEORGIA.

The Savannah, Florida and Western Railroad Bridge at Doctortown has no draw. The steamboats now plying on the river have low pilot-houses and hinged chimneys, and can pass under the bridge with little difficulty. With the contemplated improvement of navigation, however, this bridge will be more or less an obstacle and should be provided with a draw.

The above named are the only structures in my district, known to me, which "do or will interfere with free and safe navigation."

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT WILLIAM M. BLACK, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., December 21, 1886.

SIR: In compliance with General Order No. 7, Headquarters Corps of Engineers, Washington, November 30, 1886, I have the honor to report that to the best of my knowledge there are no bridges, causeways, or structures now erected or in process of erection in this district which do interfere with free and safe navigation.

Regarding the bridges over the Saint John's River and its tributaries, I would respectfully invite attention to the report of Capt. William T. Rossell, Corps of Engineers, dated August 30, 1884, to the effect that there were none that interfere with navigation.

The following railroad bridges will have to be arranged with draw-spans should the rivers they cross be improved by the United States above their sites, viz:

Withlacoochee River.—Bridge at Pemberton's Ferry, used by the Florida Southern and South Florida Railroad Companies; bridge at "Withlacoochee," used by the Florida Railway and Navigation Company.

Pease River.—A bridge between Owens and Fort Ogden, used by the Florida Southern Railroad Company.

Very respectfully, your obedient servant,

W. M. BLACK,
First Lieut. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN R. L. HOXIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Montgomery, Ala., February 5, 1887.

GENERAL: In compliance with General Order No. 7, Headquarters Corps of Engineers, United States Army, November 30, 1886, inviting attention to section 4 of the river and harbor act, approved August 5, 1886, and requiring report thereon, I have the honor to submit the following report of structures now erected, or in process of erection, which do, or will, interfere with free and safe navigation.

COOSA RIVER, GEORGIA AND ALABAMA.

* * * * * * *

The Columbus and Western Railway Company have just commenced building a bridge across the Coosa River near Childersberg, Ala. It will be an iron bridge 650 feet long. Length of first two spans, 150 feet each; third span, 200 feet, and fourth span, 150 feet. Height of lower chord above lower-water mark, 40 feet; above high-water mark, 5 feet. The piers will be of stone upon solid rock foundation. There will be no draw in the bridge, but the 200-foot span will be put in with a view to make a draw of it when necessary.

I am informed that the Rome and Decatur Railroad Company contemplate building a bridge over the Oostenaula River, near Rome, Ga., but I have as yet been unable to ascertain the proposed character of the structure, or to get any definite information from the parties interested.

OCMULGEE RIVER, GEORGIA.

* * * * * * *

The bridge of the Covington and Macon Railroad (finished October, 1886), crossing the Ocmulgee River about 1 mile below that of the Central Railroad at Macon, Ga., is an obstruction.

This bridge is located on the site of the Macon and Augusta Railroad crossing, and consists of a 30-foot span from the abutment on the right bank to the first pier, a 120-foot span to the second, and a 150-foot span to the third; under this span is the channel, with good river above and below. Another 150-foot span connects with the fourth pier, which is on the left bank of the river. The mouth of Walnut Creek is crossed by a 180-foot span to the fifth and last pier, and from this pier to the abutment on the left bank, a distance of 300 feet, there are twenty-one bents of trestle. The four spans are of Whipple truss with 22, 24½, 24½, and 27½ depth of truss, the lower chord being 30 feet above low water. The piers consist of two 10-foot steel tubes, filled with concrete.

No arrangement has been made for the passage of steamboats.

OCONEE RIVER, GEORGIA.

* * * * * * *

A tramway and wagon bridge crosses the Oconee River at Dublin, Ga. The distance from abutment to abutment is 265 feet, and is crossed by four 60-foot and one 25-foot spans. Arrangement has been made for draw on the right bank, both of the 60-foot openings being available at all stages of water for the passage of steamboats. The crossing is in the bight of a bend, but the approach is good in both directions; the draw is a Howe truss, the lower chord of which is 27 feet above low water. Piers are of trestle anchored with rock.

FLINT RIVER, GEORGIA.

* * * * * * *

The A., P. & L. R. R. contemplate building a bridge across the Flint River between Albany and Montezuma at a point known as Gum Creek, 40 miles below Montezuma. No definite information has been received from the parties interested.

* * * * * * *

ALABAMA RIVER, ALABAMA.

A wagon-bridge crosses this river at the town of Selma, Ala.; it is provided with a draw-span having an available opening for navigation. The location of the bridge and of the draw-span are badly chosen, and the draw requires supplementary works to assist the passage of boats through it.

By direction of the Secretary of War the owners of the bridge were notified April 19, 1886, * * * "to prepare a channel for the passage of boats between the pivot-pier and the north bank for all stages of water exceeding a 24-foot stage; the width of channel to be 75 feet, and the depth 4 feet when the river is at a 24-foot stage. At the same time, 5 cast-iron snubbing-posts to be planted securely in the bank, and all as indicated in the accompanying sketch. This, with the understanding that if at any time in the future it should be necessary to provide further facilities for navigation, the bridge company shall then be required to alter and change the said bridge at its own expense in such manner as may be proper to secure free and safe navigation without impediment." No information has been received that this work has been done.

* * * * * * *

Very respectfully, your obedient servant,

R. L. HOXIE,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

NOTE.—Reference to such bridges as were reported by Captain Hoxie to comply with river and harbor act of 1884, are omitted in the above. For which see Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

REPORT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., February 3, 1887.

SIR: In compliance with General Orders No. 7, November 30, 1886, I have the honor to report the railroad bridge (Alabama and Great Southern) crossing the Tombigbee River at Jones's Bluff, Alabama, now erected, interferes with free and safe navigation.

A railroad bridge (West Alabama) is in process of erection across the Tombigbee River at Jackson, Ala., but in the absence of any information as to the set of the current at different stages of water it is impossible to state at present whether it will or will not interfere with free and safe navigation.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR W. H. HEUER, CORPS OF ENGINEERS.

OFFICE UNITED STATES ENGINEER,
New Orleans, La., December 16, 1886.

GENERAL: Referring to General Orders No. 7, dated Headquarters Corps of Engineers, United States Army, Washington, D. C., November 30, 1886, directing reports to be made as to whether any bridges, causeways, or structures now erected or in process of erection do or will intefere with free and safe navigation, I have the honor to report as follows with reference to my district:

On the Bayou Teche, Louisiana, about 10 miles below Port Barré, La., is a pile-bridge without a draw which, if not remedied, will interfere with the free navigation of this stream. The president of the police jury in Saint Landry Parish promises to have the bridge so modified that it will not interfere with navigation.

On the following streams recently examined under act of Congress of August 5, 1886, there are bridges which, if the streams should ever be improved, would be obstacles to navigation, but at present, as the streams are not navigable, the structures are not obstacles:

Bayou Plaquemine, Louisiana.—Just inside the Bayou Plaquemine near its junction with the Mississippi River is a solid-earth dike or causeway built across the bayou by order of the police jury. This dike was built about twenty years ago.

About a mile away from the Mississippi River there, is on the Bayou Plaquemine, a pile-bridge without a draw, on which the Texas and Pacific Railroad crosses this stream.

Bayou Vermillion, Louisiana.—On this stream, about 2 miles below where the Morgan Railroad crosses the stream on its bridge, is a low wooden pile-bridge called "Pinhook Bridge" without a draw.

Very respectfully, your obedient servant,

W. H. HEUER,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN J. H. WILLARD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Vicksburg, Miss., December 22, 1886.

SIR: Referring to General Orders No. 7, current series, from your office, I have to invite attention to the annual reports of my predecessor for 1885 and 1886, and to special reports of December 9, 1884, and June 18, 1886, giving detailed information in regard to obstructions by bridges of South Forked Deer River, Tennessee, Big Black River, Mississippi, and Red River at Shreveport, La.

Chapter 180, Laws of the United States, approved August 5, 1886, provided in the item of $5,000 for Big Black River, Mississippi, "that no part of this appropriation shall be used until the State of Mississippi shall have first caused the bridges over said stream south of the Vicksburg and Meridian Railroad to be so constructed as not to obstruct the navigation of said stream." I learned informally from the attorney-general of the State that no action had been taken by the State as yet, and accordingly made no recommendations in my project dated August 20, 1886. No appropriation was asked in the Annual Report for 1886, and no further estimates will be made for this stream until the bridges shall have been rebuilt to afford free navigation. As this is a matter between the United States and a State, it is submitted that the officer in charge of this district cannot properly enter into correspondence with the governor on the subject.

Nothing has been done about the obstructions in South Forked Deer River, and no complaints in regard to them have been received at this office since the letter (376, R. and H., 1886) forwarded with indorsement of your office of February 19, 1886.

The examination and report on the shoal in the west draw-span at Shreveport was reported June 18, 1886, and a letter from the office of the Chief of Engineers ($\frac{320}{111}$, '86) was transmitted to the president of the railroad company July 17, 1886, requesting compliance with section 8, chapter 229, Laws of the United States, approved July 5, 1884. If anything has been done by the company to improve the obstructed channel I have not heard of it.

The east channel is sufficient for present needs of commerce, and no complaints have been received at this office from any person interested in the navigation of Red River.

The same company is now replacing the wooden draw-bridge over Bayou Macon by an iron draw-span. This information has been received lately from the superintendent in charge of improving Tensas River and Bayou Macon, Louisiana. No plans or information in regard to the proposed construction have been submitted to this office.

I learn to-day that the Georgia Pacific Railroad Company (narrow gauge) has begun the construction of a bridge over Big Sunflower River above Johnsonville, Miss. It is presumed that a draw-bridge is contemplated; otherwise complaints would have been made by persons interested in the navigation of this stream, either to this office or in the public prints.

No plan or other information have been furnished by the company.

Very respectfully, your obedient servant,

J. H. WILLARD,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN HENRY S. TABER, CORPS OF ENGINEERS

UNITED STATES ENGINEER OFFICE,
Little Rock, Ark., February 3, 1887.

GENERAL: In accordance with the requirements of General Orders No. 7, dated Headquarters Corps of Engineers, United States Army, Washington, D. C., November 30, 1886, that there are no bridges, causeways, or structures now erected, or in process of erection, that do or will interfere with the free and safe navigation of any improved river, or improved reach of river, in this district.

The following bridges over streams for which appropriations have been made and not yet expended do interfere with the free and safe navigation of such streams, viz:

A wagon bridge at Rocky Crossing, upon the Petit Jean River. This bridge should be altered without delay, as improvements are to be begun as soon as the water reaches a proper stage.

The following bridges over streams for which appropriations have been recommended will interfere with the free and safe navigation of these streams when improved, viz:

One railroad bridge, owned and operated by the Memphis and Little Rock Railroad, over the Cache River, Arkansas.

One railroad bridge, owned and operated by the Saint Louis, Iron Mountain and Southern Railway Company, over the same river.

One railroad bridge, owned and operated by the Saint Louis, Arkansas and Texas Railroad Company, over the Saint Francis River at or near the town of Saint Francis, Ark.

One railroad bridge, owned and operated by the Saint Louis and San Francisco Railroad Company, over the Arkansas River at or near Tulsa, in the Indian Territory.

One railroad bridge, owned and operated by the Missouri, Kansas and Texas Railroad Company, over the Arkansas River, about 2 miles above the mouth of Grand River, Indian Territory.

A bridge over the Saline River, near Rison, Ark., owned and operated by the Saint Louis, Arkansas and Texas Railway Company, interferes with the free and safe navigation of that river from February 1 to June 1 each year.

There is a bridge in process of erection over the Poteau River, Arkansas, that will be an obstruction to the free and safe navigation of that river. This is being built by the Saint Louis and San Francisco Railway Company.

These two latter cases are instances of bridges over streams navigable by the laws of the United States, though the particular reach spanned by these bridges has never been improved by the General Government.

I am, general, very respectfully, your obedient servant,

H. S. TABER,
Captain of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF MAJOR A. MACKENZIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., December 14, 1886.

GENERAL: General Orders No. 7, Headquarters Corps of Engineers, United States Army, current series, requires a report upon certain pro-

or shore, draw-span is not more than 85 feet, a width insufficient for the safe passage of rafts of the ordinary size, even when guided by steamers, without further assistance from shears or booms properly constructed and placed. In addition, the right draw-span is frequently reduced in navigable width by accumulations or jams of floating logs, which lodge against the square, up-stream face of the pier to the right of the draw-pier. This pier should be altered in plan, or a sheer should be placed above it to divert floating bodies to the adjoining spans, and a boom should be placed along the left bank to assist rafts in making the left draw-span.

I understand that parties interested in the navigation of the Chippewa River have endeavored, but without success, to induce the bridge-owners to place booms, as required by the terms of the act of the legislature authorizing the construction of the bridge.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Major of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Chattanooga, Tenn., January 26, 1887.

GENERAL: In compliance with General Orders No. 7, Headquarters Corps of Engineers, November 30, 1886, I have the honor to submit the following report, having reference to "bridges, causeways, or structures now erected or in process of erection," that "do or will interfere with free and safe navigation" upon the Tennessee and Cumberland rivers and navigable tributaries.

1. Five bridges spanning the Tennessee River are of this character, forming complete or partial obstructions, as hereinafter shown, viz:

(*a*) The bridge which is now an absolute barrier to ordinary steamers is located at Florence, Ala., and was built by the Memphis and Charleston Railroad Company, upon a branch line of that road connecting Florence with the main line at Tuscumbia, about 7 miles distant.

At the time of its construction, this point was considered the head of navigation on the Tennessee River, as the Mussel Shoals, just above, practically closed this river to vessels of all classes. The piers of this bridge are quite near together, and being placed at an angle to the current, which is very swift, render the passage of vessels extremely difficult and dangerous.

This bridge is built for combined railroad and carriage traffic, has no draw, is of 17 spans of about 100 feet length, and has an elevation above high water of only 1½ feet and above low water of about 33½ feet. It was built with reference to light traffic, and is not considered sufficiently strong to admit the passage of the heaviest engines and trains in general use on other roads. It is a total barrier at all stages of the water to steamboats of the usual size plying upon our western rivers.

In view of the near completion of the Mussel Shoals Canal, and its being opened to navigation within the next twelve months, and the increase of the commerce of the Tennessee consequent upon communication to its upper tributaries, it would appear to be obligatory in the interests of navigation that this Florence bridge be abated, or be modified to the extent of the removal and reconstruction of at least three of its piers. The new piers should be placed parallel with the current of the river, and the distance between them, owing to the velocity of the current, should not be less than 150 feet in the clear, the middle pier of the three to carry a turning bridge.

Information has reached me informally that commercial interests in that region will soon demand a bridge adapted to heavier traffic, and pending such construction, or positive action looking thereto, I urgently press the necessity of an official declaration of the obstructive character of the present bridge to "free and safe navigation."

In this connection, reference is respectfully made to my letter of December 16, 1886, to the President *etal.* of the East Tennessee, Virginia and Georgia Railway Company, and the reply thereto, dated January 8, 1887. (Appendixes A and B.)

(*b*) The bridge of the Memphis and Charleston Railway at Decatur, Ala., is also an obstruction to the present and prospective commerce of the river. It consists of 12 spans of about 154½ feet average available length; it has the narrowest draw—53½ feet—of any bridge crossing the Tennessee or Cumberland rivers. It is readily seen that with an increased commerce, and increased size of steamboats plying upon the river, that the draw-span should be enlarged to not less than 150 feet in the clear. In this connection see Appendixes A and B.

(*c*) The bridge of the Nashville, Chattanooga and Saint Louis Railway Company at Bridgeport, Ala., is an obstruction now and will be more so in the future. It has five spans of an average length of about 140 feet; a draw of only 65½ feet in width, and it is of faulty construction, so as to present a constant peril to life and property even to the small craft that now have to pass it. As in the case of the Decatur bridge, and for the same reasons, the draw should be enlarged to a width of not less than 150 feet in the clear, to provide even the present commerce with "free and safe navigation."

In this connection reference is made to my letter of December 27, 1886, to the president *et al.* of the Nashville, Chattanooga and Saint Louis Railway Company, and the reply thereto, dated January 19, 1887. (See Appendixes C and D.)

(*d*) The bridge at Johnsonville, Tenn. (Nashville, Chattanooga and Saint Louis Railway), is of nine spans, each of about 164 feet average length, having a draw of 97 feet width (estimated). This bridge is rendered a serious obstruction by reason of its faulty construction. The river is undermining its draw-piers, and to partially prevent this damage the company has deposited large masses of stone in the waterway, thus narrowing the channel and causing the formation of constantly enlarging sand-bars below the bridge.

Navigation reasonably demands that this obstructive riprap be removed. The piers, in my judgment, should be rebuilt, and the draw widened to not less than 150 feet in the clear, the interests of commerce and the safety of life and property afloat requiring it.

On December 27, 1886, I addressed a letter to the Evansville, Paducah and Tennessee River Packet Company, asking for information pertaining to the present condition, &c., of this bridge. (See Appendix E.) The reply thereto forms Appendix F. In Appendix C inquiry was also made of the Nashville, Chattanooga and Saint Louis Railway Company, but no mention was made of this bridge in their reply. (Appendix D.)

(*e*) The bridge of the Chesapeake, Ohio and Southwestern Company, at Gilbertsville, Ky., operated by the Newport News and Mississippi Valley Company, is a very serious obstruction to "free and safe navigation."

It has nine spans of about 150 feet average width, and a draw of only 100 feet width. It is not built at right angles to the current; the upper rest-pier is actually in the channel used by boats, and the lower rest-pier has fallen in.

The present and prospective commerce demands that the piers should be rebuilt, and a draw of not less than 150 feet in the clear should, in my opinion, be constructed so as to amply provide for safely navigating the Lower Tennessee River.

In this connection I respectfully refer to my letter to the Newport News and Mississippi Valley Company, dated January 7, 1887, and the reply thereto, dated January 12, 1887. (Appendixes G and H.)

Also to the statement of the Evansville, Paducah and Tennessee River Packet Company in reference to this bridge. (Appendix F.)

2. The Hiawassee River is spanned at Charleston, Tenn., by a bridge of the East Tennessee, Virginia and Georgia Railway; it has no draw; has three spans of 120 feet width; its height above low water is about 36 feet. There has been no serious complaint of this bridge to my knowledge, but the fact remains that when the river is at a good boating stage only the smallest class of steamboats can pass under it. A draw will become a necessity when the commerce of the river is still further developed by the improvements begun and projected above Charleston. (See Appendixes A and B.)

3. The bridges herein described are undoubtedly obstructions in fact, though they may not be obstructions in law, having been erected under State legislative authority, Congress having been silent in the matter; but in the interests of the commerce and navigation of the present and of the near future it is respectfully submitted that the modifications herein suggested, or such as will be productive of like results, should be adopted and enforced by the declarative action of Congress assenting thereto.

4. The log-booms formed in the Upper Cumberland have been heretofore complained of by raftsmen, but these "structures" are not deemed of sufficient importance to need official abatement at present; at least no complaints of any recent date have been received.

Very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

APPENDIX A.

LETTER OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS, TO THE EAST TENNESSEE, VIRGINIA AND GEORGIA RAILWAY COMPANY.

ENGINEER OFFICE, UNITED STATES ARMY,
Chattanooga, Tenn., December 16, 1886.

GENTLEMEN: In view of the recent national legislation bearing upon the subject of bridge and other structures that "do or will interfere with free and safe navigation" I have respectfully to call your attention to certain bridges under your control that do interfere with such navigation.

(1) The bridge over the Tennessee River at Florence, Ala., upon the Memphis and Charleston Division of your system, is, in my opinion the worst of the obstructions upon that river, and, as a matter of fact, presents a serious barrier to navigation as

carried on even now in boats that ply in the Tennessee below Florence and above Decatur, and in view of the near completion of the Mussel Shoals Canal and the consequent increase of commerce, calling into use upon the Tennessee a larger class of steamboats, this bridge will then form an absolute barrier to navigation.

It is well known to your honorable body that this Florence bridge has no draw, is very low, of narrow spans, and its piers located without regard to the direction of the current, which is very strong, and is structurally slender and weak. In fact, of the bridges that cross the Tennessee and Cumberland rivers and their tributaries it has the shortest available span (100 feet) and the least height above the high-water surface, having at that stage only 1½ feet and above the low-water surface it has about 33½ feet.

(2) The bridge at Decatur, Ala., crossing the same river, is also a serious obstruction, having a very narrow draw—53½ feet—the narrowest draw in any bridge crossing the Tennessee or Cumberland rivers, and which will, in all probability, be prolific of loss and damage to the craft seeking to pass through its piers.

(3) The bridge over the Hiawassee River at Charleston, Tenn., has no draw, has short spans, and only 36 feet above the low-water surface. "Free and safe navigation" cannot be had for steamboats under these conditions when the river is at a good boating stage.

In view of these facts it is readily seen that the Florence bridge should be provided with a draw-span of suitable dimensions (I suggest 150 feet) or be abated, and that the Decatur bridge should be modified to the extent of constructing a draw of sufficient dimensions to render the passage of boats safe and without unusual risk to life and property, and that a draw in the Charleston bridge is desirable, though the amount of commerce may not at present make it imperative.

It is respectfully desired that your company will favor me with an early reply, embodying its views upon this matter, with such suggestions as may be deemed pertinent thereto, and if any action has been taken, or is likely to be taken in the near future, having in view the modification or abatement of either of said bridges, that I may be officially informed of said facts, so that I may be enabled to give them careful consideration, and to submit "all information attainable" with my report to the War Department upon this subject of obstructions in the navigable waters of the engineer district in my charge.

In this connection please read the following copy of "orders":

"HEADQUARTERS CORPS OF ENGINEERS,
"UNITED STATES ARMY,
"*Washington, D. C., November* 30, 1886.

"GENERAL ORDERS,
"No. 7.

"The attention of officers of the Corps of Engineers * * * is invited to the following provision contained in section 4 of 'An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes,' approved August 5, 1886:

"'SEC. 4. The Secretary of War shall * * * report to Congress * * * whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation.'

"Officers and agents will prepare and submit to this office, as soon as practicable, full and detailed reports covering all facts within their knowledge and all information attainable by them, that the Chief of Engineers may present to the Secretary of War the data necessary to enable him to comply with the above-quoted provision of the river and harbor act of August 5, 1886.

"By command of Brigadier-General Duane:

"JOHN M. WILSON,
"*Lieut. Col. of Engineers, Colonel U. S. Army.*"

I am, gentlemen, very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers,
In charge of Improvements of Tennessee and Cumberland rivers, &c.

The PRESIDENT, DIRECTORS, ET AL.,
Of the East Tennessee, Virginia and Georgia Railway Company.

APPENDIX B.

LETTER OF THE VICE-PRESIDENT OF THE EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD COMPANY TO LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

EAST TENNESSEE, VIRGINIA AND GEORGIA RAILROAD COMPANY,
Knoxville, Tenn., January 8, 1887.

DEAR SIR: The president of this company has referred to me your communication under date of the 16th ultimo, calling attention to the fact that certain bridges on the Memphis and Charleston and East Tennessee, Virginia and Georgia railroads interfere with navigation. Absence has prevented an earlier reply.

The East Tennessee, Virginia and Georgia Railway Company operates the Memphis and Charleston Railroad as lessee, and expenditures for the reconstruction of bridges can only be made by authority of the Memphis and Charleston Railroad Company. The president of that company, with whom I have conferred on the subject, advises me that the question of putting a draw into the Florence Bridge was up for consideration some years ago, and his company then took the position that in view of the fact that Florence had been declared by statute the head of navigation at the time the company's bridge over the Tennessee River at that point was constructed, any changes necessary on account of the extension of navigation should be made at the expense of the Government out of the fund appropriated for the improvement.

Whether or not this position is tenable I do not pretend to say; the matter has been referred to the legal department of the company for advice.

Upon diligent inquiry I have learned that so far the bridge over the Tennessee River at Decatur has not proved any obstruction to navigation. Whether the completion of the river improvements will make such changes as will necessitate the substitution of a wider draw-bridge remains to be seen.

In regard to the East Tennessee, Virginia and Georgia Railway Company's bridge over the Hiawassee River I will say that the commerce above that bridge is so very small, and not likely to increase in the near future, that the consideration of the question of putting a draw in that bridge can, in my opinion, be deferred.

Yours, very respectfully,

HENRY FINK,
Vice-President.

Lieut. Col. J. W. BARLOW.

APPENDIX C.

LETTER OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS, TO THE NASHVILLE, CHATTANOOGA AND SAINT LOUIS RAILWAY COMPANY.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., December 27, 1886.

GENTLEMEN: In view of the recent national legislation bearing upon the subject of bridges and other structures that "do, or will, interfere with free and safe navigation," I have to respectfully call your attention to certain bridges under your control that do interfere with such navigation.

(1) The bridge over the Tennessee River at Bridgeport, Ala., is now, in my opinion, a serious obstruction, and in view of the near completion of the Mussel Shoals Canal and the consequent increase of commerce, calling into use upon the Tennessee River a larger class of steamboats, this bridge will then form an obstacle demanding modification.

This bridge, as your honorable body well knows, is of short spans and narrow draw (65¼ feet), and forming by its faulty construction a constant peril to life and property seeking to pass through it.

(2) The bridge at Johnsonville, Tenn., over the same river, is also a very serious obstruction, and in consequence of faulty construction, causing the undermining of the draw-piers, to remedy which your company has deposited masses of stone, thus narrowing and obstructing still further the already too narrow channel.

In view of these facts, it is readily seen that the Bridgeport Bridge should at least be modified to the extent of enlarging the draw to suitable dimensions (I suggest 160 feet), and that the Johnsonville Bridge should have its draw-piers rebuilt, and the draw widened.

It is respectfully desired that your company will favor me with an early reply, embodying its views upon this matter, with such suggesions as may be deemed pertinent thereto, and if any action has been taken or is likely to be taken in the near future, having in view any modification of either of said bridges, that I may be officially informed of said facts, so that I may be enabled to give them careful consideration, and to submit "all information attainable" with my report to the War Department upon this subject of obstructions in the navigable waters of the engineer district in my charge.

In this connection, please read the following "Orders:"

[Here follows a copy of General Order No. 7, which may be found in Appendix A.]

* * * * * * *

I am, gentlemen, very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers,
In charge of Improvements of Tennessee and Cumberland.

PRESIDENT, DIRECTORS, ET AL.,
Of the Nashville, Chattanooga and Saint Louis Railway.

APPENDIX D.

LETTER OF THE PRESIDENT OF THE NASHVILLE, CHATTANOOGA AND SAINT LOUIS RAILWAY TO LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

NASHVILLE, CHATTANOOGA AND SAINT LOUIS RAILWAY,
OFFICE OF PRESIDENT AND GENERAL MANAGER,
Nashville, Tenn., January 19, 1887.

DEAR SIR: Referring to yours of December 27, with reference to our bridges over the Tennessee River at Bridgeport and Johnsonville, would respectfully state that I am at a loss what answer to give in regard to this matter.

The Bridgeport Bridge was constructed in 1850, under an act of the Alabama legislature. It has not interfered with the navigation of the river for a period of thirty-five years, and should it in the future do so, owing to a larger class of boats that may be placed upon the river after the completion of the improvements at Mussel Shoals, whether the requisite changes should be made by this company, by the Government, or by both jointly I am unable to say.

Yours, truly,

J. W. THOMAS,
President.

Col. J. W. BARLOW,
United States Engineer.

APPENDIX E.

LETTER OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS, TO THE SUPERINTENDENT OF THE EVANSVILLE, PADUCAH AND TENNESSEE RIVER PACKET COMPANY.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., December 27, 1886.

DEAR SIR: In October 1884, you kindly furnished my predecessor, Maj. W. R. King, a statement showing the condition of the bridges over the Tennessee River at Gilbertsville (Chesapeake, Ohio, and Southwestern Railway), and at Johnsonville (North Carolina and Saint Louis Railway), in regard to their obstructing the channel and imperiling the lives and property of those navigating and commercially using the Tennessee River.

Not having been able in the few months that I have had charge of the improving of the Tennessee River, to personally inspect the bridges and the Lower Tennessee River generally, I ask you to be kind enough to furnish me a statement of the present relation that each of these bridges bears to commerce and navigation.

As your boats are constantly plying upon the river, there is no person, I think, who can give me more trustworthy information than yourself.

An early reply is very necessary, as I am required to report on the matter to the War Department without delay.

Very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers.

JAMES MONTGOMERY, Esq.,
Superintendent Evansville, Paducah and Tennessee River Packet Company.

APPENDIX F.

LETTER OF THE SUPERINTENDENT OF THE EVANSVILLE, PADUCAH AND TENNESSEE RIVER PACKET COMPANY, TO LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

EVANSVILLE, PADUCAH AND TENNESSEE RIVER PACKET COMPANY,
Evansville, Ind., *January* 3, 1887.

MY DEAR SIR: Yours 27th ultimo to Mr. James Montgomery, superintendent Evansville, Paducah and Tennessee River Packet Company, concerning bridges on Tennessee River, has been referred to me, as I have succeeded him in the office of superintendent.

I cannot give you exact measurement, &c., but can give you a general idea of these bridges, based on an experience of eighteen years continuous service between Paducah, Ky., and Florence, Ala.

The Chesapeake, Ohio and Southwestern Railroad Bridge, 20 miles above Paducah, is considered very dangerous by all Tennessee River steamboatmen, and more especially in high water, as it is not constructed at right angles with the current of the river.

The upper rest-pier is almost exactly in the channel that a boat should run in order to keep straight with the current, which is very essential to safety. I herewith inclose you a drawing * that will give you a better idea of the situation than I can describe in a letter.

The Louisville and Nashville Railroad Bridge, 90 miles above Paducah, is not all that we desire in the way of construction, though it is so much better than the Chesapeake, Ohio and Southwestern, and also the Johnsonville Bridge, that we have no special complaint to make concerning it.

The Johnsonville Bridge, which is 110 miles above Paducah, is the most difficult one we have to contend with, and is considered dangerous to steamboats both ascending and descending when being navigated by the most skillful pilots, either in daytime or at night, on account of the short span and a large gravel-bar, which has formed only a short distance below the bridge. I also inclose a drawing* of this bridge and bar, which is not according to exact measurements, but it is in the main correct.

The bar spoken of is less than the length of a steamboat below the end of the draw when the draw is open for boats to pass. In consequence of this bar a pilot has to begin to make a turn when descending while the boat is yet between the piers, and in ascending the channel is so narrow and crooked it is impossible to get a straight run between the piers.

I have often noticed that a boat 34 feet wide with a coal-boat 20 feet wide in tow, has barely room to pass through this bridge. Even then at a low stage of water the boat will rub on one side and the barge on the other against the riprap which has been thrown around the piers in order to support them. Some years ago Major Willard, who was then in charge of the work at Mussel Shoals, made a trip on one of our boats, and, if I am not mistaken, made a sketch of the Johnsonville Bridge and the bar below it. If I am correct about this statement concerning Major Willard, I think he could give you more accurate information than any one else.

There are three regular weekly boats running in the Lower Tennessee all the year round, and a considerable portion of the time as many as six, in addition to tow boats that often make trips up the river for the purpose of bringing out barges loaded with staves, lumber, pig-iron, tan-bark, and timber.

Some months ago we furnished your office, through Messrs. Fowler & Co., of Paducah, with an approximate statement of the business done on the Tennessee River between Paducah, Ky., and Florence, Ala. This statement, while it was not gotten up from actual statistics owing to the fact that no records have been kept of the amount of towing, we consider it as near accurate as it could have been made, as it was prepared by careful and experienced men who have been connected with the business for many years. If you now have this statement it would give you some idea of the importance of the commerce on the Lower Tennessee. We feel a great interest in these matters and will cheerfully give you all the information we can, and stand ready to render all the assistance in our power looking to the permanent improvement of this important stream.

I shall endeavor to call on you soon if you so desire, in order that these matters may be fully discussed.

Yours very truly,

R. D. MORROW,
Superintendent.

Col. J. W. BARLOW,
Lieut. Col. of Engineers.

---

*Omitted.

APPENDIX G.

LETTER OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS, TO THE NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY.

ENGINEER OFFICE, U. S. ARMY,
Chattanooga, Tenn., January 7, 1887.

GENTLEMEN: In view of the recent national legislation bearing upon the subject of bridges and other structures that "do or will interfere with free and safe navigation," I have to respectfully call your attention to the draw-bridge crossing the Tennessee River at Gilbertsville, Ky., forming a part of the western division of your system, *i. e.* on the Chesapeake, Ohio and Southwestern Railway. This bridge forms a very serious obstruction to navigation and should be remedied with as little delay as possible.

Definite and well-sustained complaints have been made to my predecessor, Maj. W. R. King, and more recently to myself, by those interested in the commerce and navigation of the Tennessee, extending over a period of several years, against that bridge to a degree that implies a necessity for its modification or abatement.

The obstruction chiefly consists in the fact that it is not constructed at right angles with the current of the river, and that its lower rest-pier has fallen in, and "the upper rest-pier is almost exactly in the channel that a boat should run in order to keep straight with the current, which is essential to safety."

In view of these facts it is readily seen that the piers should be rebuilt, at the same time securing a draw-span of not less than 150 feet in the clear.

It is respectfully desired that your company will favor me with an early reply, embodying its views upon this matter, with such suggestions as may be deemed pertinent thereto, and if any action has been taken or is likely to be taken in the near future having in view any modification of said bridge, that I may be informed officially of that fact so that I may be enabled to give it careful consideration and to submit "all information attainable" with my report to the War Department upon this subject of obstructions in the navigable waters of the engineer district in my charge.

In this connection please read the following "Orders."

[Here follows a copy of General Orders No. 7, which may be found in Appendix A.]

* * * * * * * *

I am, gentlemen, very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers,
In charge of Improvement of Tennessee and Cumberland rivers.

PRESIDENT, DIRECTORS, ET AL.,
Newport News and Mississippi Valley Company.

APPENDIX H.

LETTER OF THE PRESIDENT OF THE NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY TO LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY,
New York, January 12, 1887.

DEAR SIR: I have to acknowledge receipt of your letter of the 7th instant, calling my attention to a provision in the Army regulations requiring you to report to the Secretary of War whether any bridges, causeways, or structures do, or will, interfere with the free and safe navigation, and pointing out that there is a liability to an obstruction to navigation in the railroad bridge piers at Gilbertsville, Ky.

This company has but recently taken charge of the division of road extending from Louisville to Memphis, and I am without specific information in regard to the condition of this bridge and the piers. I have requested General Echols, the vice-president, who is in immediate command, however, to cause an examination and report to be made to me as to the present dimensions and condition of that structure, so as to be able to comply with the reasonable requirements of the War Department as soon as the seasons and elements favor. When I obtain the views of the resident engineer I may have some plans and suggestions to submit for consideration on the subject in a further communication.

Yours very respectfully,

C. P. HUNTINGTON,
President.

J. W. BARLOW,
Lieut. Col. of Engineers.

LETTER OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Chattanooga, Tenn., February 19, 1887.

SIR: I have the honor to transmit herewith correspondence received from C. P. Huntington, president of the Newport News and Mississippi Valley Company, dated New York, February 7, 1887, furnishing additional information pertaining to the bridge of the Chesapeake, Ohio and Southwestern Railway over the Tennessee River at Gilbertsville (Eddyville), Ky., and request that this communication may be filed as supplementary to my report of January 26, 1887, on bridges obstructing navigation.

The interests of commerce and navigation demand, in my judgment, that the two rest-piers be removed at once; therefore I respectfully recommend their removal under the provisions of the act of July 5, 1884, section 8, the cost being estimated as within the $15,000 annual limit.

This action will give temporary, but not full relief, for the necessity of securing a wider draw-span would still remain; the draw should be widened to not less than 150 feet in the clear, as previously recommended by me.

Very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE PRESIDENT OF THE NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY.

NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY,
New York, February 7, 1887.

DEAR SIR: Referring to your letter of the 7th ultimo, already acknowledged, I have now to say, in further response thereto, that I have requested Vice-President Echols to give me a report upon the condition of the bridge across the Tennessee at Eddyville, and have the pleasure to inclose copy of his report relative thereto.

It will be seen therefrom that the chief engineer does not regard the present condition of any of the piers as being an obstruction to navigation, but nevertheless, if upon an inspection and maturer judgment, the Secretary of War is of the contrary opinion, it will be practicable to remove the lower rest-pier.

Respectfully submitted,

C. P. HUNTINGTON,
President.

J. W. BARLOW, Esq.,
Lieut. Col. of Engineers.

LETTER OF THE VICE-PRESIDENT OF THE NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY.

NEWPORT NEWS AND MISSISSIPPI VALLEY COMPANY,
OFFICE OF THE THIRD VICE-PRESIDENT,
Louisville, Ky., February 2, 1887.

MY DEAR SIR: On the 12th ultimo you wrote to me inclosing copy of a letter from Mr. J. W. Barlow, lieutenant-colonel of Engineers, United States Army, in charge of improvement of the Tennessee and Cumberland rivers, calling your attention to what he thought was an obstruction of navigation by our bridge-piers in the Tennessee River.

I have referred the matter to our engineers, and they have returned to me a tracing* showing the location of the piers at our Tennessee River bridge, which tracing I inclose to you herewith. They report that there are clear draw-spans on each side of the round pier of 123 feet each, which is ample for larger boats than are run on the Tennessee River.

The bridge-piers are placed so nearly parallel with the current, that there can be no reasonable objection on that score. The rest-piers, however, being at right angles to the line of the bridge, might be objected to as being in a measure in the way of entering the draw-spans with the current. The lower rest-pier has fallen down, and I do not think it is in the way; but if it is, what is left of it can be removed. The upper rest-pier is a very good thing to have, though not a necessity; and if the Government insists upon it, this pier can be taken down; and with these two piers out of the way no reasonable objection can be found to this bridge by the river interests.

My understanding is that this bridge was approved, at the time of its erection, by the Government, and I think that the cost of any change which they may now insist upon should be paid by the Government; but I really think when Colonel Barlow comes to look into the matter further he will be satisfied that no change is necessary.

Yours, very truly,

JOHN ECHOLS,
Third Vice-President.

REPORT OF MAJOR AMOS STICKNEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Louisville, Ky., February 8, 1887.

GENERAL: I have the honor to submit herewith the reports of my assistant, Mr. O. L. Petitdidier, upon the bridges across the navigable portions of the Wabash River and White River, Indiana, and concur in his recommendations. Of the twenty-two bridges across the Wabash, all but three are more or less obstructions to the free and safe navigation of the river at certain stages of the water. In the present condition of the navigation interests, however, these obstructions are not of so much importance as they might become after a thorough improvement of the river. On the White River two bridges are obstructions, and the one near Hazleton should certainly be changed, if the improvement of the river is to be continued, as it absolutely stops the passage of boats.†

There are no other known obstructions, caused by the erection of structures, in the district in my charge.

Very respectfully, your obedient servant,

AMOS STICKNEY,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. O. L. PETITDIDIER, ASSISTANT ENGINEER.

LOUISVILLE, KY., *February* 8, 1887.

MAJOR: I have the honor to submit my report on the examination of Wabash River bridges, made between January 12 and January 21, 1887.

The total number of bridges between Lafayette and the mouth of the river is 22, of which 8 have no draw and are total obstructions at the highest stages of river, except for very small boats; 11 are provided with a draw but no guiding-dikes, and are only partial obstructions; and 3 are provided with both draws and dikes, and are no obstructions.

---

* Omitted.

†The two bridges on White River above referred to were reported to the Senate, and report printed in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session, page 34.

The bridges having no draw and which are total obstructions at high stages, are as follows:

No.	Name.	Location.	Clearance.				Remarks.
			Low water.		High water.		
			Ft.	*In.*	*Ft.*	*In.*	
1	Brown Street Wagon Bridge.	Lafayette, Ind..	34	5	8	5	Formerly provided with a draw, but it has been removed some fourteen years ago.
2	Main Street Wagon Bridge.	....do	33	6	7	5	No draw.
3	Lake Erie and Western Railroad Bridge.	....do	34	0	8	0	Do.
4	Wabash, Saint Louis and Pacific Railroad Bridge.	Attica, Ind	40	0	14	0	Has no draw, but is sufficiently high to accommodate present needs of navigation.
5	Chicago and Indiana Coal Road (formerly Chicago and Great Southern Railroad) Bridge.	....do	36	0	10	0	Has no draw.
6	Free Wagon Bridge, built by adjoining counties.	... do	32	6	6	6	This is a new bridge just completed to replace former bridge, which was blown down in May, 1886; no draw. Sketch of this bridge is part of this report.
7	Indiana, Bloomington and Western Railroad Bridge.	Covington, Ind..	33	6	7	6	No draw.
8	Toledo, Saint Louis and Kansas City (formerly Columbus and Saint Louis) Railroad Bridge.	Near Lodi, Ind..	30	8	4	8	Do.

NOTE.—Nos. 2, 3, 4, 5, 7 reported to the Senate and report printed in Senate Ex. Doc. No. 12, Forty ninth Congress, first session, page 33.

The clearance or clear space under bridges, as shown in the above table, was obtained when the stage of water was lower than at previous examinations, and it is believed to be very nearly correct. The two sets of figures in the column of clearance, refer, the upper one to the clearance at low water, the lower one to the clearance at highest water; the difference in height between highest and low water having been assumed, the same as at Terre Haute, viz, 26 feet. Major Miller, in his report of September 30, 1884, in regard to the bridges, writes as follows:

"These bridges require, to render them no obstruction to free navigation, to be supplied with draw-spans placed over the channel, having a width in the clear of at least 60 feet, arranged to be manœuvered with facility and rapidity with proper guide dikes or guard piers."

The radical modifications to all these bridges which Major Miller recommends, seem to me to be beyond the requirements of present or future navigation on the river between Lafayette and Terre Haute, and I would recommend that it might be made optional with the various bridge owners as to whether a draw and guard pier should be built, or their bridges raised high enough to obtain a clearance between bottom of lower chord and highest water mark of not less than 20 feet or more. In my opinion, high bridges, with such a clearance as just described, would be much less objectionable than bridges provided with draws, which are generally too narrow to be passed through without some danger and which always occasion some loss of time.

* * * * * * *

Respectfully submitted.

O. L. PETITDIDIER.

Maj. AMOS STICKNEY,
Corps of Engineers, U. S. A.

REPORT OF MAJOR JAMES C. POST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, December 20, 1886.

GENERAL: In compliance with General Orders No. 7, Headquarters Corps of Engineers, United States Army, Washington, D. C., November 30, 1886, I have the honor to submit the following report upon the bridges and other structures, now erected or in the process of erection, that do or will interfere with free and safe navigation upon the rivers in the district of which I have charge.

In my previous report upon this subject, dated February 3, 1885, and printed in Senate Ex. Doc. No. 12, Forty-ninth Congress, first session, a complete list of the obstructions, of the nature referred to, then in existence was given.

* * * * * * *

The recommendations heretofore made are renewed.

The only bridge constructed since my former report is over the Little Kanawha River, at Parkersburg, between the Wood County Bridge and the mouth of the river, about 300 feet from the latter. The proposed construction of this bridge was mentioned in the report referred to, and it was recommended that on account of the importance of the mouth of this river as an ice-harbor and landing for the Ohio River steamers, that its dimensions be required to conform to the law regulating the construction of bridges across the Ohio River in that vicinity.

Under date of May 25, 1886, another report upon the effect of the construction of this bridge as then proposed upon the commerce of the Ohio and Little Kanawha rivers, was submitted to the Chief of Engineers. The piers of the bridge having at that time been commenced, it was suggested that the Ohio Valley Construction Company, engaged in building it, be enjoined from continuing the work until the subject could be more fully considered.

This report was forwarded to the Attorney-General by the Secretary of War. No further action being taken, the construction of the bridge was continued, and it has since been nearly completed. The distance between the center of the piers of the channel-span as they stand is 300 feet. This, diminished by the thickness of the piers, gives a distance between them of 284 feet 6 inches at a 10-foot stage. They are placed oblique to the thread of the current, which further diminishes this distance about 3 feet, making the navigable width between the piers, or that measured in a direction perpendicular to the river, 281 feet, or more than 10 feet less than the distance between the abutments of the Wood County Bridge, also reported as an obstruction to navigation. The clear height of the new bridge above the water at a 10-foot stage is 50 feet 4 inches. The principal objections to this bridge are that it destroys a former landing of Ohio River steamers, and prevents the use of the mouth of the Little Kanawha River as an ice-harbor. The need of places along the Ohio River where steamers can remain protected from the running ice is so seriously felt that at several points artificial ice-harbors have been built by the Government, and the construction of others is contemplated.

It is believed changes in the plan of this bridge could have been made that would have caused it to be much less of an obstruction to commerce than at present, and have added but a small additional amount to the cost of building it.

Very respectfully, your obedient servant,

JAS. C. POST,
Major of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN CHARLES E. L. B. DAVIS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., December 13, 1886.

SIR: In accordance with General Orders No. 7, Headquarters Corps of Engineers, United States Army, Washington, D. C., November 30, 1886, I have the honor to submit the following report upon bridges, causeways, or structures, now erected or in process of erection, that do or will interfere with free and safe navigation within the district of river and harbor works under my charge.

The county of Door, State of Wisconsin, granted Leatham and Smith, of Sturgeon Bay, Wis., a charter to build a wagon bridge across Sturgeon Bay, upon plans to be approved by the Secretary of War.

These plans were submitted to the Secretary of War, but as the Sturgeon Bay Canal was owned by a private corporation, the Secretary decided he had no jurisdiction, and declined to take any action or to authorize the officers of the Corps of Engineers to take any action in the case.

Messrs. Leatham and Smith, I am informed, then found out unofficially the usual rules governing the bridging of navigable streams in the United States, changed their drawings to correspond, and have already commenced the building of the bridge.

Very respectfully, your obedient servant,

CHAS. E. L. B. DAVIS,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR THOMAS H. HANDBURY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., February 4, 1887.

GENERAL: In reply to your telegram, received yesterday p. m., in regard to the reports on bridges required by General Orders No. 7, Headquarters Corps of Engineers, November 30, 1886, I have the honor to state that soon after assuming charge of this office I took steps to collect the data necessary to comply with this order. It was my intention to submit drawings of all bridges not yet reported upon over streams in my charge, similar to those that accompanied my report upon the same subject, dated January 6, 1885, at the time I was temporarily in charge of this office.

The data for these are usually furnished through the courtesy of the owners or operators of the bridges. In those cases where I have made application the information desired has been very slow coming in, which accounts for my present delay in this matter.

There are but two streams in my charge that are crossed by bridges that come within the requirements of section 4, river and harbor act, approved August 5, 1886—the Calumet River in Illinois and Indiana, and the Illinois River.

Since the date of the last report on these above mentioned, there has been added to the Calumet River the reach extending from the "Forks to one-half mile east of Hammond." In this distance the river is crossed by five bridges—three finished, and two in the process of construction. The situation between the mouth of the river and the Forks is substantially the same as given in report above mentioned.

Of the five bridges, the first met with in ascending the stream is at Burnham. It is being built by the Pennsylvania Company, and will conform to the river in its improved condition. The pivot pier and abutments are in place, and the superstructure is being erected. The first are stone resting upon pile foundations; the second is iron. The clear opening for the passage of boats will be about 70 feet. This bridge is reasonably well located, and when finished will offer the least practicable obstruction to navigation. About 2 miles above this in the city of Hammond, Ind., three railroad bridges are located within a space of about 350 feet.

(1) The Louisville, New Albany and Chicago, with a clear opening for the passage of vessels of about 50 feet.

(2) The New York, Chicago and Saint Louis, with about the same opening.

(3) The Chicago and Atlantic, with two clear openings of about 60 feet each.

The first and second of these bridges materially obstruct navigation by reason of their narrow draw openings and the obliquity of their axes to the direction of the channel. The last, however, is well located with reference to the direction of the channel and has draw openings that will admit of the easy passage of ordinary vessels. After passing the last of these railroad bridges about 700 or 800 feet, we come to a wagon bridge belonging to the city of Hammond. The old wooden structure that occupied this site for some years is at present being replaced by a new iron one.

The location is good with reference to the direction of the channel, but the draw openings provided being only 39 feet, it will be a great obstruction to navigation.

As soon as the river traffic in this locality increases to any considerable extent, as it is certain to do at an early date, it will be found that all of these bridges are much too low. As they are now, for every tug that passes, the draws must be opened.

We have the data on hand for making the drawings of four of these bridges, and hope soon to obtain that for the fifth.

They are now well under way and will be forwarded with a more detailed report as soon as completed.

With regard to the bridges over that portion of the Illinois River (from Copperas Creek to the mouth) on which the United States Government is carrying on works of improvement, their status is essentially the same as when reported upon January 6, 1885.

The Chicago and Alton Railway Company have constructed aids to navigation at their bridge at Grand Pass, which are in accordance with the suggestions of the steamboat men, and are deemed to be sufficient for the present needs of the river commerce.

Some correspondence has taken place with the owners and controllers of the other bridges over this reach of the river with regard to aids required in order to facilitate the passage of river crafts through their draw openings, and it is believed that these will be constructed in time to benefit commerce during the coming season.

From Copperas Creek to the junction of the the Illinois and Michigan Canal at La Salle the slackwater improvements on the Illinois River are owned and controlled by the State of Illinois. Over this reach of the river there are four railroad bridges, including one at Lacon, proposed, and four wagon bridges. These have not yet been reported upon.

Under date of March 31, 1886, I was instructed by the Chief of Engineers to prepare and transmit to his office at an early day a map of the Illinois River from the junction of the Illinois and Michigan Canal to its mouth, showing the location of the bridges on the river, together with skeleton sections of each after the manner adopted in the maps attached to General Warren's report of 1878.

On April 7, 1886, I submitted a project for carrying out these instructions. Under date of April 10, 1886, I was informed that "in view of your report of the expense of procuring the information desired and of the delay attendant upon awaiting for a fall in the river to make the necessary examinations, the above mentioned instructions are for the present recalled."

Since this time nothing more has been done in this matter.

It has been my intention to refer to it again and ask that the original instructions be renewed in order that they might be carried out during the coming summer and fall as favorable opportunity offered. There is no doubt but our information concerning the bridges over the Illinois River is very incomplete, especially in view of the important bearing that these will have upon the navigation of the river when it becomes a highway for vessels passing from Lake Michigan to the Mississippi River.

I will also invite attention to the fact that there are three railroad, seven wagon road, and one aqueduct bridges over the Illinois and Des Plaines rivers, between the the mouth of the canal and Joliet, that will have to receive consideration whenever the upper part of the river is to be made navigable.

Very respectfully, your obedient servant,

THOS. H. HANDBURY,
Major, Corps of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF MAJOR MILTON B. ADAMS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Burlington, Vt., December 14, 1886.

GENERAL: In compliance with General Orders No. 7, Headquarters Corps of Engineers, Washington, D. C., November 30, 1886, I have the honor to report there is one case in this district in which a bridge interferes with free and safe navigation, being that of the Lamoille Valley Extension Railroad in its crossing of Missisquoy Bay.

At least one accident has been reported to me as having occurred at this bridge, due to the narrowness of the draw, which, with projections that exist below water-level, affords a clear opening of only some 36 feet and renders a passage through the draw somewhat difficult and dangerous.

This bridge is not now in use, never was much more than merely placed in operation, and is not likely to be used in the near future; all considerations would therefore seem to render it unwise to allow such an obstacle to free navigation to remain.

Very respectfully, your obedient servant,

M. B. ADAMS,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN A. H. PAYSON, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., December 23, 1886.

SIR: In compliance with the instructions in General Orders No. 7, dated Headquarters Corps of Engineers, Washington, D. C., November 30, 1886, I have the honor to report as follows: Concerning bridges in the district under my charge, in my opinion there is no reasonable ground for complaint against any of the existing bridges, nor have any such complaints been made by the navigation interests save in the case of the bridge across the Sacramento River at Butte City, now under construction, but nearly completed. Under date of June 18, 1886, I wrote to the Department about this bridge, which had not then been begun, and inclosed a copy of a letter which I had received on the subject from the President of the Sacramento Transportation Company. I quote from my letter as follows:

> My own knowledge of the circumstances and locality convince me that the bridge, if built in this part of the river, will be a serious obstacle to navigation, if it does not entirely prevent it at certain seasons of the year.
>
> There is abreast of Butte City a straight reach of river less than 300 feet wide between permanent banks, in which the current at high water is so swift that an empty barge cannot be towed up in midstream by existing steamers. As the water is deep enough at all stages, this objection might be met by a draw-span next the bank on the Butte City side, but this even, if there was any way of forcing it, would not remedy the great danger to which descending boats with loads will be exposed.
>
> A boat coming down-stream at high water with a loaded barge, on account of the narrowness of stream and swift current, could not round to between the bend above and the bridge to drop the barge through from above, and could not tow through without great risk.

I may add that my opinion about this bridge, as above expressed, remains unchanged, as does that of Captain Dwyer, President of the Sacramento Transportation Company, who may be considered as fully representing the navigation interests on the Sacramento River.

Very respectfully, your obedient servant,

A. H. PAYSON,
Captain of Engineers.

CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CHARLES F. POWELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oreg., January 7, 1887.

SIR: I have the honor to make the following report concerning certain structures now erected or in process of erection which interfere, or will interfere, with free and safe navigation:

POUND-NETS, FISH-TRAPS, AND FISH-WHEELS.

The former of these structures are extensively used near the mouth of the Columbia River, and the fish-wheels in the river next below the Cascades Canal. Fish-traps are coming into use on the bays and lower parts of streams of the Oregon and Washington coasts.

The pounds and traps and their effect on navigation have been described in special reports and in my report of December 12, 1884, required by Department letter, for compliance with a provision of the river and harbor act of July 5, 1884, concerning structures interfering with navigation.

The fish traps and pounds in a lesser degree generally cause shoaling. The traps are, in effect, permeable dikes, which check the current and cause more or less of a fill. They contract the water-way and deflect the current, on account of the obstacle to the flow which they form in themselves and from the fills made by them.

Wherever the channel is good enough this contraction or deflection is unnecessary and is apt to be injurious to the channel, and therefore obstructive to navigation. The traps are also obstructions in another view, and that is, that a vessel may in darkness or fog run into the trap and suffer damage, be delayed, or be thrown out of her compass course.

On the other hand, where the channel is not good, fish-traps may be arranged to improve it, and at such places be, on the whole, a benefit to navigation.

The location of fish-traps and similar structures, consequently, ought to be regulated for the protection and amelioration of navigable waters, and preferably by the War Department, which is charged with the execution and maintenance of works for the objects named, and which has agents in direct supervision of such works.

No authority is exercised or delegated by Oregon or Washington Territory in locating or limiting fish pounds, traps, or wheels. Existing laws concern size of openings and times of use of traps. Structures named are built as a right of the land-owner, the same as a public wharf or landing pier would be.

The waters are public property. Bridges and the location of wharves generally are regulated, but they are for use of the public, while fish-traps, of which fish-pounds are one kind, and fish-wheels are wholly private.

Some of the Cascades fish-wheels are permanent structures of cribs and rough stone walls; others are floating.

They are generally located on the low sharp points which help to form the rapids, and all of them have runs or chutes and sometimes wings partly made by building walls of rip-rap in the river-bed.

The fish-wheel structures decrease the river cross-sections, and, consequently injuriously affect the current at the rapids, although not to a large degree. The removal of the fish-trap structures from along the channel shores will be advisable when this part of the river becomes navigated, and be necessary when the work of a radical open-river improvement is undertaken, as contemplated by the Cascades Canal project.

LOG-BOOMS IN NAVIGABLE WATERS.

Besides the instances of obstructive log-booms of this district, named in my report of December, 1884, the following have since been noticed or reported:

A boom at Coquille City, Oreg., extends half a mile up-stream following the shore. The opposite bank is fairly well protected by natural plantations; but an erosion there is plain, and one probably caused by the channel contraction made by the boom and large logs held in it.

A boom about 2 miles above Parkersburg, also on the Coquille River, is in deep water, and occupies about one-quarter of the river's width where that is somewhat narrow.

There is a boom of logs moored close to the channel at the mouth of the Nootsack River, Bellingham Bay, Washington Territory. This boom is pivoted at one end, and at times swings across the channel. It is also reported that this boom has caused, and will continue to cause, a shoal at that place.

BRIDGES AND BULKHEAD AT WATERS OF YAQUINA BAY, OREGON.

The railroad bridges and trestles and county bridge at Yaquina Bay, named in my report for December, 1884, remain without change.

The Oregon Development Company, singly or in connection with the railroad company, is building a crib-work bulkhead along the channel edge at Yaquina City, the terminus of the Coast and Willamette Valley Railway, and filling behind the bulkhead with earth and stone from adjacent bluffs.

The location and the bulkhead, now about constructed, are shown on the accompanying sketch.* The injury to navigation due to this bulkhead is inappreciable, and perhaps none exists whatever. It is understood that the bulkhead is to be extended along the channel edge in front of the tide flat between Yaquina City and Newport. The channel edge is close to the low-water line.

A filling of this tide flat would appreciably curtail the tidal prism of the bay and be prejudicial to the improvement at its entrance.

If the bulkhead were placed at about the half-tide line, and the bottom from there to the channel dredged, deep water for landing-wharves would be obtained and the encroachment of the tidal prism by the filling compensated for.

The railway company claim a grant from the State of actual ownership of the tide flat referred to and other tide flats.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, December 10, 1887.

The Secretary of War has the honor to transmit to the House of Representatives a letter of the 8th instant from the Chief of Engineers, together with copies of reports of officers in charge of river and harbor districts, received since February 21, 1887, and made to meet the requirements of section 4 of the river and harbor act of August 5, 1886, requiring that report be made to Congress whether any bridges, causeways, or structures of any kind now erected, or in process of erection, do or will interfere with free and safe navigation.

WILLIAM C. ENDICOTT,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., December 8, 1887.

SIR: I had the honor to submit, 21st February last, a communication containing reports from officers in charge of river and harbor districts, made, under orders from this office, to comply with a provision of section 4 of the river and harbor act of August 5, 1886, requiring that report be made to Congress whether any bridges, causeways, or structures of any kind, now erected or in process of erection, do or will interfere with free and safe navigation. This was transmitted to the Senate by the War Department, February 24, 1887, and printed as Senate Ex. Doc. No. 105 of the last session of Congress.

---

* Omitted.

The instances of interference therein enumerated were such as had not been included in a previous report from this office, made to comply with similar provision of the river and harbor act of July 5, 1884, transmitted to the Senate December 18, 1885, and printed as Senate Ex. Doc. No. 12, Forty-ninth Congress, first session.

In further compliance with the act of August 5, 1886, I now have the honor to submit herewith reports received since my communication of February 21, 1887, of instances of interference with free and safe navigation by bridges and other structures, additional, with few exceptions, to those previously reported.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WILLIAM C. ENDICOTT,
Secretary of War.

REPORT OF MAJOR JARED A. SMITH, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Me., June 21, 1887.

SIR: In compliance with instructions in General Orders, No. 7, from Headquarters Corps of Engineers, dated June 2, 1887, I have the honor to submit the following report:

Regarding the railroad and highway bridge between Portsmouth, N. H., and Kittery, Me., my annual report for Cocheco River, New Hampshire, for fiscal year ending June 30, 1886, contained the following paragraph:

> The bridge across the Piscataqua River, near Portsmouth Harbor, has its draw very narrow and badly arranged, so that it is generally a very inconvenient, slow, and tedious process to pass vessels through. In passing through the draw with the tide it is generally necessary to moor the vessel and allow it to drop through the narrow space stern foremost, requiring great pains to accomplish it without injury.

Across the channel leading to the Back Cove in Portland Harbor, Maine, are two bridges. The first bridge is that of the Grand Trunk Railway, which has a draw giving a clear opening of only about 40 feet, and is inconveniently arranged for enabling vessels to pass.

The second bridge is known as Tukey's Bridge, and is used for a common highway; the draw is no wider than that of the railway bridge, and owing to the narrow channel and lack of suitable guard-piers it is a difficult and tedious operation to pass vessels through the draw, so that it forms a serious obstruction to the navigation of that channel.

My report of a preliminary examination on the Kennebec River, Maine, submitted December 27, 1886, contained the following paragraphs:

> The draw of the bridge from Gardiner to Pittston is difficult and somewhat dangerous to pass, owing to the lack of suitable piers as guides to the current and guards for the passing vessel. I give this upon the statement of pilots and others, without personal knowledge obtained from observation.
>
> The bridge seems to have had an effect in forming a shoal in front of the wharves immediately above, and the shoal has extended downward until it has injured the channel through the draw; opposite the railroad wharf the shallow water causes great inconvenience and expense in getting vessels to and from the landing.

Referring to the injuries caused by a freshet in 1870, the same report says:

> The same freshet carried away the toll-bridge at Hallowell, leaving the piers in the river. The remains of the bridge piers are now submerged at high water and form a dangerous obstacle on which many vessels have been injured.

I am informed that a railroad bridge has been constructed across the navigable portion of the York River, Maine, for the improvement of which an appropriation was made by Congress, August 5, 1886. So far as I am aware, no authority has been obtained from Congress for constructing the bridge mentioned, and it is therefore not known how far it may cause obstruction.

The points mentioned cover all that are known to exist within the limits of works in charge of this office.

Very respectfully, your obedient servant,

JARED A. SMITH,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR WILLIAM R. LIVERMORE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, R. I., November 4, 1887.

SIR: Referring to General Orders, No. 7, Headquarters Corps of Engineers, current series, respecting the interference with free and safe navigation by bridges, causeways, and other structures, I have the honor to state that complaint has been made of the bridge of the Boston and Providence Railroad Company, which crosses the Pawtucket (Seekonk) River, Rhode Island, near its mouth, between the city of Providence and East Providence, and of the Old Colony Railroad Bridge over the Taunton River between Somerset and Fall River, Mass.

PAWTUCKET RIVER BRIDGE.

About 500 feet above this bridge is a highway bridge connecting Providence and East Providence, which was erected in lieu of the old Washington Bridge, which was about 250 feet above the railroad bridge and has been removed.

I quote the following description of the railroad bridge, and of the difficulties experienced in passing through it and the old Washington Bridge, from the annual report of the late General Warren for 1874:

> The act authorizing the construction of the present bridge, built in 1867-'68, passed the general assembly in 1866. This act provided that the draw of the bridge should be at least 60 feet in width, and that the proposed bridge and draw should be located in a manner satisfactory to Robert Sherman, esq., of Pawtucket. The first condition has been carried out; as to the latter, I am not informed.
>
> This bridge is 396½ feet long, divided into three spans and a draw. Commencing on the west side there is first a span of 113 feet; next one of 108¼ feet; next is the draw, 154 feet, with openings of 60 feet in the clear; and last, a short span of 20½ feet, one end of which rests on a stone pier, the only one in the bridge, the other end resting on the abutment. The superstructure is a Howe truss.
>
> * * * * * * *
>
> To facilitate the passage of vessels through this and Washington Bridge, double lines of piling have been put in between the draws of the two bridges. This piling has been extended about 300 feet above Washington Bridge, and one line has been extended about the same distance below the railroad bridge. The space between these lines of piles varies from 38 to 60 feet.

The difficulties of navigation through these bridges were clearly set forth in the report of General Warren, from which the above extract is taken.

Colonel Elliot reported upon these bridges on December 8, 1884, and again on December 21, 1886. In the latter report Colonel Elliot states that—

> Although the passage of the draw of the railroad bridge has been somewhat ameliorated by the increase of distance between the two bridges, essentially the same difficulties are experienced as before, and as stated in my report of December 8, 1884, published in Ex. Doc. No. 12, Forty-ninth Congress, first session.
>
> The draw of the new bridge is well located near the middle of the channel, and it has two draw openings, each 80 feet wide in the clear.
>
> The draw of the railroad bridge is not on or near the prolongation of the draw of the upper bridge, as it should be, but is near the eastern side of the river in a concave bend, and its single available draw opening is practically but about 45 feet wide.

Colonel Elliot further states:

> As the existing condition cannot be much longer endured by the navigation interests of the Pawtucket River, it is a striking example of the impolicy on the one hand of any corporation or individual constructing any bridge over a navigable stream without first obtaining the consent of Congress and the approval of the plans of the bridge, and on the other, of the United States permitting such construction without such consent and approval.

There has been a material change in the railroad bridge during the past year. The available width of the one draw opening has been increased from about 40 to 60 feet. A line of piling has been driven as a guide through this opening, and the city of Providence has placed a similar line south of the Washington Bridge, so that there is a continuous line of guide piles from one bridge to the other, with the exception of an opening of about 100 feet midway between the two bridges. The draw opening of the railroad bridge is now nearly or quite in line with the eastern draw opening of the Washington Bridge, and the piling has been carried below the railroad bridge some 250 feet, on a curve of perhaps 250 or 300 feet radius, following the general trend of the river at this point. This improvement has been of substantial benefit to the navigation of the river, and it removes in part the objections which have heretofore been made against the design and location of this bridge.

This bridge lies wholly within the State of Rhode Island.

The United States are dredging a channel in Pawtucket River above this bridge to a depth of 12 feet at mean low water, at an estimated cost of $380,000.

SOMERSET BRIDGE.

This bridge crosses Taunton River between Somerset and Fall River, at an angle of about 45 degrees with the current and with the general course of the stream. It has a draw of a total length of 185 feet, which rests upon a pier oblique both to the direction of the current and of the bridge, as shown on the sketch herewith. The width of the draw opening is about 73 feet in the direction of the axis of the bridge, or 53 feet in a direction at right angles to the current.

The average strength of the tidal current through the draw is a little over 2 feet, and 1½ feet, per second, at the strongest part of the ebb and flood, respectively.

Complaint is made that the draw of this bridge is closed 15 minutes before the time for the passage of trains, and as trains are often delayed for a considerable time this becomes a serious inconvenience to navigation. Tows of four or five vessels are frequently required to pass the draw, and are subjected to more or less danger by this delay. As the draw-protection makes an angle of about 34 degrees with the current, it becomes necessary for vessels either to run through obliquely to the current or to make a short turn in the draw.

Without changing the location of this bridge, it appears that the requirements of navigation could best be fulfilled by placing the draw-protection parallel to the current and increasing the draw opening.

The bridge lies wholly within the State of Massachusetts.

More than $150,000 has been expended by the General Government in improving the river above this bridge.

Very respectfully, your obedient servent,

W. R. LIVERMORE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., June 10, 1887.

SIR: Referring to General Orders No. 7, Headquarters Corps of Engineers, U. S. Army, June 2, 1887, I have the honor to state that no change has taken place in the number or construction of the bridges, causways, etc., over navigable streams in this district since my full and detailed report on the subject dated January 7, 1887, made in compliance with General Orders No. 7, series of 1886, from your headquarters, except that in place of the old wooden bridge over the Schuylkill River, at Market street, a new iron bridge is in process of erection. Like the other bridges above Chestnut street, it will have no draw.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. WILLIAM F. SMITH, UNITED STATES AGENT.

UNITED STATES ENGINEER OFFICE,
Wilmington, Del., October 28, 1887.

GENERAL: In compliance with instructions in General Orders No. 7, Headquarters Corps of Engineers, current series, I have tho honor to submit the following report concerning the bridges upon the rivers and harbors in this district that interfere with navigation.

A report on this subject was submitted January 10, 1887, and printed in Senate Ex. Doc. No. 105, Forty-ninth Congress, second session. There have been no changes in the construction of the bridges mentioned in that report, and my recommendations are renewed. In addition to that report I submitted, on May 3, 1887, to the Chief of Engineers the following:

> I have the honor to report that a franchise was granted in 1885 by the legislature of the State of Delaware to the Philadelphia, Wilmington and Baltimore Railroad Company to construct two bridges across the Christiana River, which forms what is called the harbor of Wilmington. I learn from good authority that it is the intention of the company to begin to build these bridges at an early day.
>
> The upper one is situated 5,700 feet above the Market Street Bridge and is distant on a line on the axis of the current 200 feet below the bridge of the Wilmington and Northern Railroad Company. It makes an angle of about 15 degrees 15 minutes with that bridge.

The project adopted by the Board of Engineers (see page 775, Part I, Annual Report of the Chief of Engineers for 1881) is for the improvement of the Christiana River to the Delaware Railroad Company's Bridge, 6,500 feet farther up the river.

The nearness and obliquity of the proposed bridge to the Wilmington and Northern Railroad Company's Bridge offer a serious obstacle to free and safe navigation.

The second bridge is situated 7,000 feet from the outer end of the jetty and 4,900 feet below the Third Street Bridge.

Both of these bridges are required to be made with draws, and the draw of the lower one is required to be worked by the railroad company.

Any draw-bridge is an impediment to the free and safe navigation of a river. The degree to which it impedes safe navigation depends of course upon the width of the draw, the facility with which it is worked, and the direction of the draw-pier with reference to the direction of the current.

All the commerce of the port of Wilmington will pass through the *lower bridge*, the draw of which is required to be sufficiently wide to permit the passage of vessels having 100 feet beam.

When the present contract for dredging is completed the channel will have a depth of 15 feet and a width of 75 feet. A draw-pier of 25 feet in width if placed in mid-channel will leave but 25 feet of channel on either side, which will amount to a practical closing of the river. The approved project for the improvement of the harbor calls for a channel 150 feet in width with 15 feet in depth. Therefore a draw-pier placed entirely on one side of the channel would not fit into the approved project. The line of the bridge as at present laid out is not at right angles to the axis of the current but on the smaller angle is 9 degrees. That would make a serious obstacle to the safe navigation of the river, taking into account a draw-pier of 225 feet in length and making an angle with the current of 81 degrees. A draw-bridge located as it is proposed to locate the one discussed, where all the water commerce of the city passes, it should be worked by steam and be manned night and day. There is no provision of law requiring either of these conditions.

I have no information as to the plans for the bridges, and there may therefore be other serious objections which I cannot with present information report. The draw of such a bridge as is proposed should be above mean high water at such a distance that tugs could pass by lowering the smoke stacks.

The following are copies of the letter of the Chief of Engineers with which this report was submitted to the Secretary of War and the indorsement of the Secretary of War thereon:

OFFICE OF THE CHIEF OF ENGINEERS, UNITED STATES ARMY,
Washington, D. C., June 3, 1887.

SIR: I have the honor to submit herewith a communication of May 30, from Mr. W. F. Smith, United States Agent, reporting that the Philadelphia, Wilmington and Baltimore Railroad Company is about to construct two bridges across Christiana River, under an act of the legislature of Delaware of 1885, which will seriously impair the work in progress by the United States for the improvement of the river.

In consideration of the opinion of Attorney-General Garland of May 1, 1886, in the matter of the railroad bridge across the Mississippi River at Saint Paul, which is as follows: "Where, however, the interests of the United States are directly concerned, as, for example, if the structure should threaten injury to, or interfere with, any work of the General Government for the improvement of the river, a civil proceeding to protect such work may be instituted in its behalf in the proper circuit court" (United States *v.* Duluth, 1 Dill, 469'"), it is respectfully submitted whether the matter is not such as should be brought to the notice of the Department of Justice for such action as it may deem proper.

Very respectfully, your obedient servant,
J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WM. C. ENDICOTT,
Secretary of War.

[First indorsement.]

WAR DEPARTMENT, *June* 8, 1887.

Respectfully returned to the Chief of Engineers.

It appears that the bridges are to be constructed under the authority of an act of the legislature of the State of Delaware.

The War Department is not authorized to take action in the case, except as provided by section 4, river and harbor act approved August 5, 1886.

By order of the Secretary of War.

JOHN TWEEDALE,
Chief Clerk.

Since my report of May 3, 1887, the work of construction of these bridges has begun.

At the upper bridge the pivot-pier is to be 36 feet 6 inches in diameter with two draw spans of 78 feet in the clear, and at the lower bridge the pivot-pier will be 36 feet 6 inches in diameter, and two draw-spans 100 feet in the clear.

Very respectfully, your obedient servant,

WM. F. SMITH,
United States Agent.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., February 21, 1887.

GENERAL: I have the honor to state that on the 24th ultimo I made a report[*] to you upon bridges, causeways, or structures in this district which interfere with free and safe navigation, as provided for in section 4 of the river and harbor act of August 5, 1886, and in General Orders No. 7, Headquarters Corps of Engineers, United States Army, series 1886. I now make the following supplementary report, as the dredging operations in progress in the southern branch portion of Norfolk Harbor, Virginia, have recently disclosed the fact that the two marine railways, belonging to Mr. John L. Thomas and Mr. William B. Thomas, respectively, "will interfere with free and safe navigation" therein as soon as the work of dredging shall have been completed.

I transmit herewith a map of the locality in question; a copy of a report, dated the 7th instant, of Mr. H. J. Gielow, assistant engineer, relative to his examination of these structures, and a copy of a communication dated June 20, 1882, from General V. D. Groner, president board of harbor commissioners, to said John L. Thomas, authorizing him to project his railway beyond the port-warden line under certain conditions.

On the 20th ultimo I wrote Capt. Charles G. Elliott, president board of harbor commissioners, as follows:

> The Government is now engaged in improving the Southern Branch by dredging to a depth of not less than 25 feet and a width of at least 500 feet at mean low water.
>
> The marine railways of John L. Thomas and William B. Thomas extend beyond the port warden lines and interfere with the foregoing.
>
> Please have them removed as soon as possible, that the work of improvement may not be delayed.

It is understood that the said board, at its meeting on the 14th instant, authorized the employment of an engineer to define the port-warden lines for the locality under consideration and report on the same. This will take some time, as many of the old marks to which points were referred have disappeared. Mr. Gielow, however, made a close approximation to the location of the port warden line in the vicinity of the said railways.

It appears from the foregoing that the railway of Mr John L. Thomas has been built under the authority of said board (whose jurisdiction over the matter may be questioned). It is on a pile foundation, and extends 93 feet, more or less, from the port warden line into the channel. At mean low water there is 13½ feet over it at the port warden line and 23½ feet at the channel end. The permit calls for "at least 25 feet" at the latter end and "some 16 feet" at the former, presumably at same stage. This structure extends 20 feet, more or less, into the 25-foot channel now being dredged.

---

[*] Printed in Senate Ex. Doc. No. 105, Forty-ninth Congress, second session.

The railway of Mr. William B. Thomas was built years ago without any known authority. It rests on mud sills on the natural soil, and extends 162 feet, more or less, from the port warden line into the channel, with 6 feet of water over it at the port warden line and 14 feet at the outer end at mean low water. It projects about 100 feet into the 25-foot channel lately dredged, and is a very dangerous obstruction to navigation.

No buoys mark the ends of either of these structures, and, if allowed to remain as now, they will be a constant menace to large vessels seeking the navy-yard, etc.

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.
(Through Col. William P. Craighill, Corps of Engineers.)

REPORT OF MR. H. J. GIELOW, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., February 7, 1887.

CAPTAIN: I have the honor to state that, in compliance with your instructions, I proceeded to locate the port warden line from point T to U in the Southern Branch on the Berkley side. Upon arrival on the spot it was found that, with a single exception, all the old landmarks, to which these and adjacent points had been referred, had ceased to exist, and to locate these points correctly would necessitate an extensive survey, requiring a week or ten days for its completion. However, an approximate location of the port warden line was made to-day with a view to obtain certain data relative to the marine railways of Messrs. John L. Thomas and William B. Thomas, as follows:

Mr. John L. Thomas's marine railway is built on a pile foundation; at the port warden line it has 13½ feet of water over it; it extends 93 feet into the stream from the port warden line, and has 23½ feet of water over it at its outer end.

Mr. William B. Thomas's marine railway has no special foundation; it rests on mud sills on the natural soil, having 6 feet of water over it at the port warden line, from which it extends 162 feet into the stream, and at which point it has 14 feet of water over it.

All the above depths are referred to mean low water.

Very respectfully, your obedient servant,

H. J. GIELOW,
Assistant Engineer.

Capt. F. A. HINMAN,
Corps of Engineers.

LETTER OF THE PRESIDENT OF THE BOARD OF HARBOR COMMISSIONERS OF NORFOLK, VIRGINIA.

HARBOR COMMISSIONERS' OFFICE,
Norfolk, Va., June 20, 1882.

DEAR SIR: In accordance with your application of the 12th of May, 1882, after hearing the advisory board, in due consideration thereof, as a matter of public importance, the board permits your ways to be extended beyond the present port warden's line 100 to 108 feet, to a depth under water of some 16 feet at the port warden's line, running down to at least 25 feet at its extremity, and proper fastening piles to be driven.

The Commonwealth's attorney for Norfolk County has been requested to draw up the proper papers in the case, and the work is to be done under the supervision of the committee on wharves and docks appointed by the board, Messrs. J. J. Williams, J. R. Gillett, and Henry Parker.

Yours respectfully, etc.,

V. D. GRONER,
President of Board.

JOHN L. THOMAS, Esq.,
Portsmouth, Va.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, November 7, 1887.

SIR: In conformity with General Orders No. 7, Headquarters Corps of Engineers, series 1887, I have the honor to submit the following report upon "bridges, causeways, or structures now erected or in process of erection" that "do or will interfere with free and safe navigation," within the district in my charge.

ASHLEY RIVER, SOUTH CAROLINA.

The new bridge built across this river at Charleston has a pivot-draw of two openings of 75.6 feet and 75.8 feet, respectively. It is located near the west bank of the river. An obstruction is formed here to the extent that some difficulty is experienced in passing through when tidal currents are strong. It is probable that the passage would be easier if the draw was nearer the center of the river.

EDISTO RIVER, SOUTH CAROLINA.

(1) The bridge of the South Carolina Railroad near Branchville has no draw. It is a single fixed span wooden bridge. It forms no obstruction at present while navigation is confined to rafting, but will probably do so when the Edisto shall have been improved for light-draught steamboats as contemplated by the existing project.

(2) Three county-road bridges, Covner's, Richardson's, and Canady's, cross the stream at reaches to be improved for steamboat navigation. When this improvement shall have been accomplished they will obstruct the passage of steamers. At present they do not interfere with raft navigation.

SALKIEHATCHIE RIVER, SOUTH CAROLINA.

(1) Toby's Bluff Bridge is too low and one bent is so much in the channel as to interfere with raft navigation.

(2) The Charleston and Savannah Railroad Bridge has no draw. The opening is 38 feet. The river is navigable for several miles higher up for light-draught steamers, but their passage is obstructed by the bridge.

CHEEHAW RIVER, SOUTH CAROLINA.

A schooner, sunk in the river about two years ago, at a point known as the "Public Landing," about 7 miles distant from Green Pond, forms an obstruction to navigation. Funds have recently been allotted for the removal of the wreck.

SAVANNAH RIVER, GEORGIA.

The bridge of the Port Royal and Augusta Railroad, about 4 miles below Augusta, Ga., gives some trouble to steam-boats at high stages of the river, although provided with a draw about 90 feet wide. The trouble is caused by the structure making an angle of about 75 degrees with the current, the piers being perpendicular to the axis of the bridge. The draw is not considered to be located near enough to the South Carolina bank of the river to afford the best passage for steam-boats.

ST. AUGUSTINE CREEK (THUNDERBOLT RIVER), GEORGIA.

The bridge of the Savannah and Tybee Railroad Company, recently built across St. Augustine Creek, presents a serious obstruction to navigation. The capping of the draw-bridge pier is only about half a foot above high water of spring tides and the roadway only about 6 feet above the same level. At high water it is scarcely possible to keep boats from being carried by the tidal current against the bridge. In view of the difficulty in passing the draw-opening of the bridge, the railroad company has recently been requested by the Secretary of War, as a partial remedy, to cause a number of groups of piles to be driven in certain positions beyond the ends of the draw-bridge piers, but as far as I know the company has not yet done anything in this matter.

ALTAMAHA RIVER, GEORGIA.

The Savannah, Florida and Western Railroad Bridge at Doctortown has no draw. The steam-boats now plying on the river have low pilot-houses and hinged chimneys, and can pass under the bridge with little difficulty. With the contemplated improvement of navigation, however, this bridge will be more or less an obstacle and should be provided with a draw.

The above named are the only structures of any kind in my district known to me, which do or will interfere with free and safe navigation.

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

SUPPLEMENTAL REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, November 11, 1887.

SIR: I have the honor to state that I have been informed that there are two bridges crossing Amelia River, above Fernandina, Fla., which more or less obstruct navigation. The river forms a part of the inland water-route between Fernandina and Jacksonville, Fla. One of these bridges is that of the Fernandina and Jacksonville Railroad; the other is the county bridge.

It appears that the railroad bridge cannot be opened to its full width, owing to the settlement of the structure or some defect in the machinery, or both, and the fender-piling is gone. A steamboat passing through the partial opening is in danger of striking the iron railing of the bridge.

The opening of the county bridge is complained of as being too narrow for steam-boats using this route. The fender-piling that used to be there is rotten to the water's edge, making the passage dangerous to the wheels of a steam-boat.

It is claimed that owing to the condition of these bridges damages have been caused to boats, and that the shipping business on this section of the inland water-route has suffered.

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN W. M. BLACK, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 28, 1887.

SIR: In accordance with General Orders No. 7, Headquarters Corps of Engineers, Washington, D. C., June 2, 1887, I have the honor to report that the following bridges in this district interfere with safe navigation for the reasons stated:

(1) Railway bridge over branch of the Ocklawaha River near Lake Dora, used by the Florida Southern and the Tavares, Orlando and Atlantic railroads. This bridge was built as a draw-bridge. It settled and the draw could not be opened easily; the draw-span is now joined to the main track at both ends by fish-plates. The waters over which this bridge passes were formerly navigated to a considerable extent. Navigation is now entirely stopped by the bridge.

(2) Railway bridge at Pemberton Ferry, over the Withlacoochee River, used by the Florida Southern and South Florida railroad companies. This bridge has no draw-span. There is no commerce in the river above this bridge at present.

(3) Railway bridge over the Withlacoochee River at Withlacoochee, used by the Florida Railway and Navigation Company. This bridge has no draw-span. There is no present commerce in the river in its vicinity.

(4) Railway bridge across Pease River, between Owens and Fort Ogden. This has no draw-span. There is no commerce in the river in its vicinity at present.

Very respectfully, your obedient servant,

W. M. BLACK,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., July 21, 1887.

SIR: In compliance with General Orders No. 7, dated June 2, 1887, I have the honor to report the—

1st. Railroad bridge (Alabama and Great Southern) crossing the Tombigbee River at Jones's Bluff, Alabama, now erected, interferes with free and safe navigation.

The following extract from the report of Mr. H. C. Fillebrown, who was sent to examine it in 1871, contained in Chief of Engineers' Report for that year, gives in detail the character of the obstruction the bridge offers to navigation:

> There can be no complaint made either regarding its construction or the width of passage-way afforded by the draw. The piers are located very nearly parallel to the course of the current, and there is a clear opening on either side of the central pier of 91 feet. In going up-stream a steam-boat meets with no delay if the draw is open, and can run through either by day or night. In coming down the river the case is different.
>
> The approach to the bridge at Jones's Bluff from above is by way of a sharp bend of the river; a narrow point makes out from the east bank just above the bridge rendering it impossible to see whether the draw is open or not until a boat is within about 400 feet of the bridge. On the west bank of the river and within 150 feet of the west abutment of the bridge there is an indentation, or "pocket," worn into the chalky cliff to the depth of 150 or 200 feet. The water rushing into this pocket forms eddies and counter-currents so strong as to very materially affect the course of a boat. Should the draw be closed at the time a steam-boat rounds the point above, it would be impossible to stop her headway until she was within the influence of these eddies. In that case they would be obliged to "back up" against these heavy currents, which would test the extreme power of the engines.
>
> The river at this point is very deep, and the main volume of the water passes along the foot of the bluff, but is deflected from the lower point of the "pocket" mentioned above, and passes under the draw at a slight angle with the piers. * * * Were the bridge located but 300 yards further down the river the difficult navigation would have been entirely avoided; as it is, there is but the distance of a good boat's length to allow a vessel to "straighten up" in after passing the point above. Taking into consideration the currents which are encountered just after a boat rounds the point, this is entirely insufficient.

(2) A railroad bridge (Mobile and Birmingham) across the Tombigbee River at Jackson, Ala., is in process of erection, which I think may interfere with safe and free navigation. As I have not been able to obtain the set of the current at the highest stages of water, it is impossible at present to state positively whether it will or not.

(3) A railroad bridge (Louisville and Nashville) crossing the west Pascagoula River has no draw opening, and is so low as to prevent navigation, except for small boats that can go under it. (Report submitted by indorsement dated June 5, 1886.)

(4) A railroad bridge (Vicksburg and Meridian) across Pearl River at Jackson, Miss., has no draw, and is so low as to absolutely prevent navigation between the portions of the river above and below, except for small boats that can pass under.

(5) A county bridge about one-half mile above railroad bridge at Jackson, Miss., has no draw, and is so low as to absolutely prevent navigation between the portions of the river above and below, except for small boats that can pass under.

(6) A county bridge across Pearl River at "Ratliffs," about midway between Jackson and Carthage, has a draw opening of only 28 feet in width; should be at least 40 feet.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF THE MISSOURI RIVER COMMISSION.

MISSOURI RIVER COMMISSION,
Saint Louis, Mo., August 11, 1887.

SIR: In compliance with the provisions of section 4 of the river and harbor act approved August 5, 1886, I am instructed by the Missouri River Commission to forward herewith a copy of the report of the Secretary of the Commission, dated June 30, 1887, upon the subject of the obstruction of the Missouri River at Camden, Mo., by a dike constructed by the Wabash Western Railway Company. This report was made in compliance with instructions of the Commission, given May 11, 1887.

Very respectfully, your obedient servant,

CHAS. R. SUTER,
Lieut. Col. of Engineers,
President Missouri River Commission.

Hon. WM. C. ENDICOTT,
Secretary of War.

(Through the Chief of Engineers, U. S. A.)

REPORT OF FIRST LIEUTENANT THEODORE A. BINGHAM, CORPS OF ENGINEERS, SECRETARY MISSOURI RIVER COMMISSION, ON OBSTRUCTIONS TO NAVIGATION AT CAMDEN, MISSOURI.

SAINT LOUIS, MO., *June* 30, 1887.

SIR: In accordance with resolution of the Commission at its last meeting, I have the honor to submit the following report on the obstruction to navigation at Camden, Mo., reported by Captain Tilden, in letter of May 10, 1887.

In company with yourself I visited Camden May 14, 1887, on the steamer William Stone. When near the dike constructed by the Wabash Railroad Company there, which forms the obstruction referred to, the steamer Wyoming was coming up through the obstructed channel. She had failed on the first trial, but succeeded on the second. An inspection of the channel at the dike was made by Captain Patterson in a skiff, as it was not deemed advisable to get the Stone too near the dike, since she might have to go below it and might have serious difficulty in getting back. It was reported that the dike was continuous from the left bank across the channel to the bar on the west side. A sort of waste-weir had been left in the middle for the passage of boats. The end of the dike on the bar was under water. The velocity of the water over the waste-weir was estimated at 5 to 6 miles per hour, and there was a sudden drop of 8 inches to 10 inches just at the lower edge. Depth of water on upper side of dike was over 10 feet, but there was only 4 feet over the dike.

I called on the railroad foreman in charge of building the dike. He said the object was to throw the river over against the right bank and prevent cutting in Camden Bend, which was seriously threatening railroad property. It was expected that the dike would be finished in time for the June rise, at which time these changes were expected to take place. Ways had been built on the bank, just above the dike, for construction of the mats used in its construction. These mats are woven of willow poles, about 90 feet by 40 feet, and 6 inches by 8 inches thick. When two of these are launched they are floated in position side by side lengthwise of the stream and sunk with riprap. Successive layers on top of each other constitute the dike.

In order to determine exactly the effect of this obstruction a survey was necessary. This was made in the latter part of May and first of June. The results are shown on the map herewith. Unfortunately the survey had to be made at a high stage of water, about 7 feet above low. At the time of the inspection above mentioned the bar, shown on the map as it existed in 1882, had worn away somewhat, and its upper end, on which the outer end of the dike rested, was more nearly opposite the line of the dike. At the time of the survey this bar had worn away much more, as seen by the map, and the river had followed its usual course of cutting *around* the end of the dike and undermining it. Owing to this fact and the swift currents and great fall at the dike, it was not found possible to locate the present outer end of the dike. Numerous cross-sections and miscellaneous soundings were made. These are shown on the map. Floats were run to show the direction and velocity of the current. Their directions are shown on the map, with the points where they cross the sounded sections and with the velocity along each line. Sections 13, 13 A, and 15 show where the outer end of the dike was, viz: on the bar visible at low water. By sections 10, 11, 13, 13 A, 15, and 16, the main channel is still seen to be over the waste-weir of the dike before mentioned. The split in the channel is shown by section 16 to be due, not to the dike, but to the tow-head below. The main channel is still down the bend. There is a channel on the west side from the head of the bar, turning sharp off toward the west bank and following this down, gradually working back to the main channel along the left bank. This western channel is a very tortuous one, as shown by the map and by the letter of Captain Keith, hereto appended; for from the head of the bar it leads out around the end of the dike. The bar shown on the map is gradually wearing away at its upper end, and there is every evidence that the only channel will soon be in the bend, where it was before, only with its point of impact moved further down stream.

So there the dike is right across the main channel, with an excessive fall on its lower edge, an excessive velocity over it, owing to its damming effect—a most serious and unwarrantable obstacle to navigation. The channel has only been divided temporarily and not totally divided.

Several letters on this subject are appended as further evidence of the nature of this obstruction, which it appears the railroad company propose to repeat at De Witt.

Prompt measures should be taken if the Wabash Western Railroad Company are to be prevented from seriously endangering the navigation which the Commission are at work to improve.

Respectfully submitted.

THEO. A. BINGHAM,
First Lieut. of Engineers.

Lieut. Col. C. R. SUTER,
Corps of Engineers, U. S. A.,
President Missouri River Commission.

LETTERS OF CAPTAIN C. B. TILDEN.

1.

KANSAS CITY, MO., *June* 28, 1887.

LIEUTENANT: The main channel of the river at Camden is still over the dike and down the bend, same as when you were up here. But at the present high stage of water in the river there is plenty around the end of the dike, but crooked and very hard to make.

There is a middle chute that looks very well, but which I did not try, and still another going over to the point, which I ran several times and found abundance of water. Of course at the present high stage it is impossible to say where the channel will be when the river falls, but I think it will remain over the dike and down the bend, same as when you were up here. I will see the pilots on the steamers Dacotah and Wyoming when they come up and obtain their views on the subject and transmit them to you as early as possible.

I am, sir, very respectfully, your obedient servant,

C. B. TILDEN.

Lieut. T. A. BINGHAM,
Corps of Engineers.

2.

KANSAS CITY, MO., *July* 20, 1887.

LIEUTENANT: Your letter of July 19 was received to-day.

In reply I would say that I saw Capt. Henry Keith, of the steamer Wyoming, on July 2, and gave him a rough draught of a letter to you expressing his views of the river at Camden and which he was to have signed by himself and the pilots of the Wyoming and then take it down to Saint Louis and get it signed by the captain and pilots of the steamer Dacotah and forward to you. The steamer Dacotah had broken her shaft on her trip up the river and returned to Saint Louis for repairs and has not since been up here.

I saw Captain Keith on Monday, the 18th instant, and asked him about it. He said he had no opportunity of getting it signed, but would attend to it on his return to Saint Louis. In case he does not do it, however, I give you below the substance of what he said about the place.

"The channel at Camden was still down over the dike, and there was little or no water the other way outside, and that, owing to this dike, it was the most dangerous place on the river to navigate."

I am, sir, very respectfully, your obedient servant,

C. B. TILDEN,
Captain.

Lieut. T. A. BINGHAM,
Corps of Engineers U. S. A.

KANSAS CITY, MO., *July* 25, 1887.

LIEUTENANT: I this morning saw Capt. George Keith, of the steamer Dacotah, who arrived here last evening with his boat. On speaking of the dike at Camden, Mo., he says:

"That he came up the middle chute and around the head of the dike; that the reef makes in very close and that the current is very swift, making it the most dangerous place on the river to navigate."

He also reports a dike in the course of construction below De Witt, Mo., which, if carried out as apparently projected, will be equally bad as the dike at Camden, piles having been already driven two-thirds of the distance across the river. He told me he would address a letter to you at once relative to this matter.

I am, lieutenant, very respectfully, your obedient servant,

C. B. TILDEN,
Captain.

Lieut. THEO. A. BINGHAM,
Corps of Engineers, U. S. A.

LETTER OF CAPTAIN GEORGE G. KEITH.

LEXINGTON, MO., *July* 26, 1887.

DEAR SIR: The dike put in below Camden is proving a great obstruction to navigation and is giving us a good deal of trouble both in going up and coming down stream. They are also putting in dikes below De Witt which will cause great trouble to navigation. I also wish to call your attention to the Randolph Bridge, which, I am satisfied, it will be impossible to pass under during high water, and hardly think it is 50 feet above high-water mark. I would feel deeply obliged if you would examine into these matters as it affects the interests of and would confer a great favor on steam-boat men generally on Missouri River.

Respectfully yours,

GEO. G. KEITH,
Master Steamer Dacotah.

Lieut. THEO. A. BINGHAM,
Secretary Missouri River Commission.

REPORT OF CAPTAIN CLINTON B. SEARS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Bismarck, Dak., June 13, 1887.

SIR: In compliance with General Orders No. 7, Headquarters Corps of Engineers, United States Army, I have the honor to report as follows:

(1) The railroad bridge of the Northern Pacific Railroad across the Big Horn River, in Montana, some two or three miles from its mouth, is a decided and complete interference with the free and safe navigation of the river.

This bridge is an iron or steel truss "through" bridge, and the horizontal bottom chord is from 8 to 10 feet only above high-water mark, and about 15 feet above low water. The Big Horn is navigable for some distance above Fort Custer, Mont.; it has been navigated to that point. The bridge in question should be provided with a draw, giving a free channel-way of at least 100 feet in width.

(2) The bridge of the Northern Pacific Railroad across the Missouri River at Bismarck, Dak., does not itself present any material interference with the free and safe navigation of said river, but, with the object of protecting the western approach to said bridge, the railroad company has constructed and is constructing a brush and stone dike parallel to and about 500 feet above the said western approach.

This dike extends out to the edge of the channel at low-water mark. The effect of it is, at any stage above low-water mark, to deflect the current so as to throw a violent and extremely dangerous cross-current directly on to the middle channel-pier of the bridge. The result is to render the passage under the bridge extremely hazardous, it being very difficult for a boat to keep from being carried against the pier with great force. Should this ever occur, the total loss of the steamer or vessel with cargo and all lives on board may be expected, as the water about the pier is from 80 to 100 feet deep, and the current very swift.

The only remedy for this is the building of a dike far enough up the river to deflect the current in such a manner as to bring it parallel to the axes of the bridge piers, for some distance above, under and below the bridge.

I would urgently recommend that steps be taken by the proper authorities to oblige the Northern Pacific Railroad Company to remedy this great interference with free and safe navigation.

(3) It is reported in the daily papers that the Chicago, St. Paul, Minneapolis and Omaha Railroad Company, in connection with the city authorities of Sioux City, Iowa, are about to begin work on the approaches and foundations for a bridge across the Missouri River at Sioux City, Iowa. I doubt the truth of this report, however, as it is probably the bridge authorized by act of Congress approved August 15, 1876, which obliges the plans for such bridge to be submitted to the approval of the Secretary of War before its construction.

Very respectfully, your obedient servant,

CLINTON B. SEARS,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN E. H. RUFFNER, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Quincy, Ill., October 31, 1887.

SIR: In compliance with General Orders No. 7, current series, Headquarters Corps of Engineers, I have the honor to report, in reference to "bridges, causeways, or structures, now erected or in process of erection," between the Des Moines Rapids and the Illinois River "that do or will interfere with free and safe navigation."

The "sheerboom" provided recently for the Quincy Bridge has been placed in good order, so that this bridge is as little of an obstruction as can be expected.

The Louisiana Bridge has, in its present condition, probably the safest and easiest passed draw-bridge on the lower part of the Upper Mississippi River.

The Hannibal Bridge is a great obstruction, and the company owning it seem not inclined to do anything for the amelioration of the difficulty of navigation caused by the bridge. A plan was prepared at one time by the bridge company, as a result of the action of Major Mackenzie, for the construction of a sheerboom from the west draw-pier to the main shore.

This plan in all its details was, upon the recommendation of Major Mackenzie, approved by the Secretary of War. About the time the company was said to be ready to purchase material, an opposition to the plan arose among the lumbermen whose rafts passed the bridge. These parties claimed that although at one time they had approved this very plan, subsequent experience taught them that their own business would be injured if they could not use the west or shore span in passing the bridge. At their urgent recommendation the construction of the sheerboom was postponed for the present.

Since that time correspondence has been had with the bridge company and a personal interview with one of their representatives, in which the company was invited to submit an alternative plan or to give some indication of their intentions. Nothing has been received, however, by me, and the matter stands just where it did a year ago. Alternative plans have been discussed slightly, but nothing definite can as yet be proposed, though, undoubtedly, something ought to be done by the bridge company, and that without further delay.

Very respectfully, your obedient servant,

E. H. RUFFNER,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR A. MACKENZIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., July 12, 1887.

GENERAL: General Orders No. 7, Headquarters Corps of Engineers, United States Army, current series, requires a report upon certain provisions contained in section 4, river and harbor act of August 5, 1886, which are as follows:

> The Secretary of War shall * * * report to Congress * * * whether any bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation.

Within the limits of the district in my charge there are numerous bridges, causeways, piers, booms and other structures erected by private parties which interfere to a greater or less extent with free and safe navigation.

All bridges are obstructions to navigation in a certain degree; but most of the bridges on the Upper Mississippi have been built under the authority of acts of Congress, and, by the provisions of section 8 of the river and harbor act of July 5, 1884, can be made in time reasonably safe and convenient for the passage of vessels and rafts. As regards Congressional authority in advance of construction, there are several exceptions; and while such bridges are no worse than others, a principle vital to the interests of river navigation—that is, obtaining permission of Congress and a consideration of plans and location by the War Department—was violated in their construction. This matter is discussed in relation to the St. Paul Railroad Bridge, in Circular No. 15, Headquarters Corps of Engineers, July 1, 1885.

There are on the Upper Mississippi numerous booms, piers, cribs, etc., which encroach upon the channel and interfere somewhat with navigation, but none of these cases are, perhaps, of sufficient importance to justify special mention. But the spirit which leads to such constructions without authority may at any time result in work which will cause the interests of navigation much annoyance.

Section 5254, Revised Statutes, provides for the erection of piers, cribs, etc., under the authority and direction of the Secretary of War, but such authority is rarely requested. It would be in the interest of navigation if the same laws prohibited the erection of such structures without the authority of the Secretary.

There are now in existence a number of acts for bridges over the Upper Mississippi which have never been taken advantage of. Some of these acts are very old and defective, and most of them were apparently obtained without any definite ideas of use, and in some cases possibly merely for speculative purposes.

As a remedy for the possible troubles which may affect the interests of navigation from the causes above enumerated, such legislation would appear advisable as will result in a general bridge law, and the prohibition of all bridges not in accord with such law; and the declaring of all structures, which encroach upon the channel and have been built without proper authority, public nuisances, and ordering their removal, and a general law repealing all bridge acts under which actual construction has not been commenced within three years of date of passage, would seem very desirable in the interests of navigation.

Very respectfully, your obedient servant,

A. MACKENZIE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL WILLIAM E. MERRILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, November 14, 1887.

SIR: In accordance with instructions contained in General Orders No. 7, Headquarters Corps of Engineers, June 2, 1887, I have the honor to submit the following report on the bridges, causeways, or structures erected, or in process of erection, within this district that do or will interfere with free and safe navigation. For convenience of reference, the location and dimensions of all bridges have been given.

The rivers under my charge are the Ohio, the Monongahela, the Allegheny, the Muskingum, the Big Sandy, the Guyandotte, the Little Kanawha, and the Buckhannon. The last four have been under my temporary charge since May, 1887.

OHIO RIVER.

The bridges in existence or under construction on the Ohio River are given in the following table:

Distance below Pittsburgh.	When completed.	Name.	Kind.	Superstructure.	Channel span in the clear.	Height above low water.	Height above high water.
Miles.					*Feet.*	*Feet.*	*Feet.*
2	......	Ohio Connecting Railway*	Railroad	Truss	400 and 500	80	45
26	1878	Beaver	do	do	426	90	45
67	1863	Steubenville	do	do	303	90	45
90	1849	Wheeling	Highway	Wire suspension.	980	92	48
94	1871	Bellaire	Railroad	Truss	322 and 220	90	40
183	1871	Parkersburgh	do	do	327 and 327	90	40
262	1883	Point Pleasant	do	do	400	91½	39
466	1872	Newport and Cincinnati	Railroad and highway.	do	400	98	36
466½	1867	Covington and Cincinnati	Highway	Wire suspension.	1,005	101	39
467	......	Chesapeake and Ohio*	Railroad and highway.	Truss	550	105½	43
469	1877	Cincinnati Southern	Railroad	do	500	102½	40
599	1871	Ohio Falls	do	do	352 and 380	96½	45½
602	1887	Kentucky and Indiana	Railroad and highway.	do	462 and 462	106½	41½
795	1884	Henderson	Railroad	do	500	99	53
965	......	Cairo*	do	do	500	105	53

* Building

The high water referred to in the above table is the high water of 1832, except in the case of the last two bridges, which are referred to the high water of 1883.

All of the above-named bridges have been fully reported on by Boards of Engineers, and no further action is now necessary. There are no other structures in the Ohio River that obstruct navigation, but at many points riparian owners are building out their banks to such an extent as to seriously reduce the water-way for floods; there seems, however, to be no law which can be invoked to prevent such encroachments.

MONONGAHELA RIVER.

The following table of bridges over the Monongahela River has been prepared by Mr. William Martin, the resident engineer at the Davis Island Dam:

Bridges.	Kind.	Distance above mouth.	Number of spans.	Channel-span.		Name of pool in which located.
				Clear width on low-water line.	Clear height above low-water.	
		Miles.		*Feet.*	*Feet.*	
Point	Highway	0.	1	780	73.8	Davis Island Dam.
Smithfield Street	....do	0.8	2	344	55	Do.
Pittsburgh, Cincinnati and St. Louis Railway.	Railroad	1.0	5	247	53	Do.
Tenth Street	Highway	1.3	3	195	54	Do.
Monongahela Connecting	Railroad	2.8	6	300	51.8	No. 1, Monongahela River.
Baltimore and Ohio (Glenwood).	....do	6.0	8	184	57	Do.
Pittsburgh, McKeesport and Youghiogheny (Homestead).	....do	8.0	6	250	54	Do.
Pennsylvania Railroad (Port Perry).	....do	11.8	9	258	57	Do.
Pittsburgh, McKeesport and Youghiogheny (McKeesport).	....do	15.5	6	221	40	No. 2, over mouth of Youghiogheny.
McKeesport, Suspension	Highway	15.5	3	305	43	Do.
Monongahela City	....do	32.5	4	216	42	No. 3, Monongahela River.
Ohio and Baltimore Short Line Railroad (Coal Center).	Railroad	52.0	4	238	52	No. 4 (no superstructure).
Pennsylvania Railroad (Redstone).	....do	56.0	4	262	40	Do.
Brownsville	Highway	57.8	3	218	41.5	Do.
Morgantown	....do	102.0	1	606	45.7	No. 9.
Fairmount	....	126.5	4	190	39	(38° askew.)

In order to accommodate the commerce of the Monongahela River, the bridges over this stream should give a clear height of 45 feet above pool level, and this should be the standard for all new bridges. Those now in existence below Morgantown (the river is not navigable above Morgantown) which have a less height than 45 feet are the highway bridges at Monongahela City, which is 3 feet too low; the Redstone Railroad Bridge, which is 5 feet too low, and the National Road Bridge at Brownsville, which is 3½ feet too low.

The lower part of the Youghiogheny is within the influence of Dam No. 2, and is navigable for a distance of 5 miles. As there are no passenger packets on this piece of river and no probability of such in the future, the bridges over the Youghiogheny, named in the table, cannot be considered as obstructions.

The clear channel-width of all Monongahela bridges should be 250 feet, and this width should be prescribed for all new bridges. I would not, however, recommend any action towards changing the channel-spans of existing bridges.

The channel-spans of the Tenth Street Highway and of the Pittsburgh, Cincinnati and St. Louis Railway bridges are obstructed by piles of refuse that should be removed.

There is urgent need of the passage of a general bridge law to regulate the construction of bridges over the Monongahela River, as the

State of Pennsylvania is constantly authorizing the construction of bridges over this river without providing for definite heights or definite channel-widths, and the just rights of navigators are at the mercy of bridge-builders. The former have had several expensive lawsuits to protect navigation, which would have been wholly unnecessary had either the State or the United States passed a general bridge law.

ALLEGHENY RIVER.

The following table of bridges over the Allegheny River has been prepared by Mr. J. W. Arras, assistant engineer in charge of the work of improvement on this river:

Distance above mouth.	Name.	Kind.	Superstructure.	Total length.	No. of spans.	Channel span between centers of piers.	Height above low water.	When built.
Miles.				*Feet.*		*Feet.*	*Feet.*	
0.	Union	Highway	Wooden trussed arch (Burr).	1,060	5	212	35.1	
0.5	Sixth street	....do	Wire suspension	1,036	4	346	33	
0.6	North side (Seventh street).	....do	Stiffened suspension-iron bars.	1,080	4	330	34.8	1884
0.7	Ninth street	....do	Wooden trussed arch (Burr).	1 044	5	209	34	
0.9	Pittsburgh, Fort Wayne and Chicago.	Railroad	Iron lattice truss	1,167	9	152	35.3	
1.8	Sixteenth street	Highway	Wooden trussed arch (Burr).	840	4	210	33	
2.4	[1] Thirtieth street	....do	Iron truss continuous girder.	760	3	302	37.5	
2.65	Pittsburgh Junction Railroad (Thirty-third street).	Railroad	Open iron truss	841.4	4	210.3 250	41	1884
3.4	Forty-third street	Highway	Wooden trussed arch (Burr).	980	4	244	37	
5.8	Sharpsburgh (Butler street).	....do	Open iron truss	905	5	181	38	
29.6	[2] Freeport (West Pennsylvania Railroad).	Railroad	....do	795	5	185	47.3	* 1887
44.9	Kittanning	Highway	Iron bowstring girder.	900	5	180	32.7	
69.5	Brady's Bend	....do	Open iron truss	750	4	200	36.2	* 1885
83.1	[3] Parker	....do	Iron bowstring girder.	790	4	197	34.5	
86.0	Foxburg	Railroad and highway.	Wooden Howe truss, decked.	530.7	3	176.9	35.3	
89.6	Emlenton	Highway	Open iron truss	456	2	228	36.6	* 1883
122.0	Big Rock	....do	Wooden truss	700	4	175	27	1879
123.1	Franklin	....do	Wood and iron truss	711	4	175	31.5	
130.2	Oil City	....do	Suspension-wire cables.	700	3	500	41	
130.4	Oil City	....do	Open iron truss	1,100	6	200	36.6	* 1885
130.6	Allegheny Valley Railroad.	Railroad	Wooden trussed arch.	450	3	150	29	* 1883
150.6	Tionesta	Highway	Iron bowstring girder.	435	4	120	25.5	
157.3	[4] Hickory	Railroad and highway.	Wooden Howe truss.	646	4	161.5	23.2	1883
165.3	Tidioute	Highway	Suspension-wire cable.	536	2	268	27.8	
187.1	Philadelphia and Erie Railroad.	Railroad	Covered wooden truss.	450	3	150	18.6	

* Rebuilt.

[1] Under construction.

[2] The original superstructure, a wooden truss and arch, is at present being taken down and a new one erected on the piers, giving an additional clear height of 9.3 feet.

[3] Two spans and one pier of this bridge were removed by an ice gorge in March, 1885; they were replaced during the same year.

[4] The Hickory Valley Railroad track was laid over this bridge in 1887.

Distance above mouth.	Name.	Kind.	Superstructure.	Total length.	No. of spans.	Channel span between centers of piers.	Height above low water.	When built.
Miles.				*Feet.*		*Feet.*	*Feet.*	
187.7	Warren	Highway	Suspension-wire cable.	452	1	452	24.4	
188.1	Buffalo, New York and Pennsylvania Railroad.	Railroad	Wooden Howe truss.	526	3	175	18	1882
189.9	Glade Run	Highway	....do	568	4	142	20.2	1882
197.7	Great Bend (Buffalo, New York and Pennsylvania Railroad.	Railroad	....do	634	4	158.5	23.1	1883
212.4	Onoville	Highway	Suspension-wire cable.	505	7	82	18.1	1884
218.2	Quaker Bridge	....do	Wooden queen truss.	300	4	75	17.5	
224.0	Red House	....do	Open iron truss	375	3	125	18.1	*1881
230.0	[1] West Salamanca.	....do	Open iron truss, parabolic channel span.	643	4	154	17	
231.1	Buffalo, New York and Pennsylvania Railroad.	Railroad	Wooden Howe truss.	394	3	146	19.6	1883
231.8	Salamanca	Highway	Iron parabolic truss	400	3	133⅓	15	1883
237.8	[2] South Carrollton.	....do	Wooden truss	280	6	84	17	1883
239.9	Tuna Creek	....do	Open iron truss	274	2	137	17	1885
240.3	Erie Railroad (Bradford Brch.)	Railroad	....do	192	1	192	12.4	1883
240.8	Buffalo, Rochester and Pennsylvania Railroad.	....do	....do	203	1	203	14.1	1883
250.6	Allegheny	Highway	Iron bowstring girder.	400	4	100	19.4	
251.8	Buffalo, New York and Pennsylvania Railroad.	Railroad	Wooden Howe truss.	329	2	164.5	17.4	1883
253.7	[3] Buffalo, New York and Pennsylvania Railroad.	....do	Wood and iron truss	306	2	171	19.5	1885
255.0	Olean	Highway	Iron truss	240	3	80	16.5	

* Rebuilt.

[1] The channel span and part of another were taken down in 1887, and a new span erected, giving an increase in width of channel of 86 feet.

[2] The channel span of this bridge fell in May, 1887. A temporary foot bridge has been erected in its place.

[3] This bridge, the superstructure of which was originally a Howe truss, was taken down in 1885; a new one was erected, having an increase in width of channel of 71 feet and a decrease in height in clear of 0.5 feet.

The first eight bridges are located in the pool of the Davis Island Dam, and their heights are measured to the surface of the pool of the dam.

In my report of February 5, 1885, printed in Ex. Doc. No. 12, Senate, Forty-ninth Congress, first session, I recommended that many of the bridges on this river should be modified in the interests of navigation, in order to conform to a standard which I named.

Inasmuch as the proposed standard was an individual one, I would now withdraw my recommendation for modification, and, in lieu thereof, would recommend that a general bridge law be enacted for the Allegheny River.

Experience shows that no dependence can be placed on State legislation, which has thus far been limited to the insertion of a clause requiring that bridges shall not obstruct navigation, but without defining what spans and heights are admissible.

The practical effect of such legislation has been to permit bridge builders to act upon their own judgment, and to force steam-boat men to resort to expensive and uncertain litigation, or else to give up navigating the river. The latter result has actually taken place on the Allegheny, and the navigation on this river is now limited to rafts, barges, and flats. During the season of good water, the latter are sometimes handled by small tow-boats, but usually they are towed by horses.

Congress has already appropriated funds for building a lock and dam in the Allegheny River about 2 miles above its mouth, and, after this is built, the subject of Allegheny River bridges will require re-examination; for the present I only recommend the passage of a general bridge law to govern the erection of future bridges, and to serve as a standard for the discussion of existing bridges.

MUSKINGUM RIVER.

This river came under the direct control of the United States on the 7th of April, 1887. The following is the report of Lieut. Lansing H. Beach, Corps of Engineers, my assistant, in local charge of this river, on the bridges now in existence between the mouth of the river and Dresden, Ohio, the head of navigation:

REPORT OF LIEUTENANT LANSING H. BEACH.

ZANESVILLE, OHIO, *November* 16, 1887.

SIR: I have to submit the following report upon the bridges across the Muskingum River and its lateral canals, as called for by General Orders No. 7, current series, Headquarters Corps of Engineers:

A table giving a list of these bridges and the data concerning them is annexed hereto.

The several bridges are so similar in characteristics and effects upon navigation that a general description will be given, subsequently adding the special features of each structure.

It can safely be said that there is not one bridge across the navigable portion of the river which does not interfere with free and safe navigation. All are draw-bridges, and all have their draw-spans much too narrow to admit of the easy and safe passage of boats under all circumstances.

In every case, too, one or other of the draw-spaces is still further contracted by a foot-way on the draw itself, which projects into the space when the draw is open.

The McConnelsville and Malta Bridge and the bridge recently built at Gaysport are the only ones that have guiding cribs at the central pier; the former has a crib on the upper side only, and this crib is too low and short to afford proper protection at all times. At the latter place the cribs are properly built, one of them being above and the other below the central pier.

The left draw in the Marietta and Harmar Bridge, although having a width of 74.2 feet, can not be turned, owing to a lack of machinery; and in any event will not be available for use by boats until the Marietta ice-harbor lock is completed, owing to the proximity of the dam and the fact that the present lock is located on the right bank.

The Beverly and Waterford Bridge is a most dangerous structure, and has frequently proved a complete obstruction to navigation. It is built diagonally to the current and channel in a bend where boats have difficulty in getting themselves in position in time to enter the draw properly. The piers are in echelon, and boats are frequently exposed to the full effects of wind and current upon one side with nothing to counteract it upon the other; the corners of the piers are as sharp as they well can be, and the faces are entirely too rough for safety to passing craft, all combining to make a condition of affairs which should not be allowed to exist.

The State of Ohio brought action against the commissioners of Washington County to compel them to change this bridge, and obtained a decree ordering a change to be made; but the case was appealed, and before it came to the second hearing the river was transferred to the United States.

The location of the draw-spaces at the Gaysport Bridge has been badly selected, and there will doubtless be trouble in the future at this point.

This bridge has been open to travel only about two months.

In several cases the lengths of bridges across the canals should be increased, since draw-spaces, equal only to the width of the locks, 36 feet, are hardly sufficient in the canals, owing to currents caused at times by the mills.

The State of Ohio seems to have allowed the builders great latitude in the location of piers and abutments, and in style of bridge, from which has resulted the present small and flimsy structures. These, however, cannot last long, and the condition of affairs can be gradually remedied.

At Zanesville there is but one bridge across the canal that can be turned; this is at Sixth street. The others can easily be placed in condition to swing properly, and this should be required.

The two bridges above Dam No. 10, viz, the Fifth Street Bridge, at Zanesville, and that belonging to the Cincinnati and Muskingum Valley Railway Company, at Ellis Station, are both complete barriers to navigation.

The former is a weak structure, and was built without authority, the board of public works not interfering. The latter seems to have been built under authority, but apparently not in accordance with the approved plan—a high span in the original drawing not appearing in the present bridge.

Very respectfully,

LANSING H. BEACH,
First Lieutenant of Engineers

Lieut. Col. W. E. MERRILL,
Corps of Engineers.

Miles above mouth.	Name.	Kind.	Superstructure.	Fixed spans.			Draw span.				Remarks.
				Number.	Total length.	Height above low water.	Total length.	Clear opening.	Height above low water.	No. of pool in which located.	
					Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*		
0	Cleveland and Marietta Railroad	Railroad	Iron truss	3	481	42.3	138.9	34.0	42.3	....	Open river.
½	Marietta and Harmar	Highway	Wood and iron truss	4	380	34.0	129.6 195.3	47.2 74.2	34.0 31.5	I.	Two draws.
11½	Lowell	do	Wooden truss	5	595	34.0	87.3	36.0	15.5	III.	Draw over canal.
12	do	do	....	....	....	....	86.5	36.0	16.3	III.	Over canal.
22	Beverly and Waterford	do	do	4	495	29.4	124.7	43.7	29.4	III.	
22½	Beverly	do	do	....	....	....	90.9	35.5	10.0	IV.	Do.
48	McConnelsville	do	do	....	....	....	87.6	35.5	14.1	VII.	Do.
48½	Malta and McConnelsville	do	do	5	491	20.5	109.0	40.0	20.5	VII.	
61	Gaysport	do	do	5	540	28.5	143.0	52.9	28.5	VIII.	
65	Taylorsville	do	do	5	785	34.8	110.5	41.0	22.9	IX.	Draw over canal.
75	Zanesville—Sixth Street	do	Iron truss	4	600	28.5	151.8	58.5	15.0	X.	Do.
75	Zanesville—Third Street	do	Wooden truss	4	410	35.0	95.7	36.0	18.1	X.	Do.
75	Zanesville—Cincinnati and Muskingum Valley Railroad.	Railroad	Wood and iron truss	4	560	36.0	116.7	34.0	15.5	X.	Do.
75	Zanesville—Main Street	Highway	Wooden truss	8	880	20.0	85.5	35.0	12.7	X.	Draw over canal. Y bridge.
75	Zanesville—Baltimore and Ohio Railroad	Railroad	Wood and iron trusses	4	520	20.0	114.8	43.0	8.5	X.	Draw over canal.
75½	Zanesville—Fifth Street	Highway	Wooden truss	5	600	22.5	....	....	....	X.	No draw.
88	Cincinnati and Muskingum Valley Railroad.	Railroad	Wood and iron truss	4	550	26.9	....	....	....	X.	Do.

Many of the above-named bridges are unnecessary obstructions to navigation, but no action against them is recommended at this present. It is deemed advisable to await the action of Congress on the proposed general bridge law for the government of future bridges over the Muskingum River, which has recently been submitted by a Board of Engineers.

There are no "structures" other than bridges which interfere with navigation.

BIG SANDY, GUYANDOTTE, LITTLE KANAWHA, AND BUCKHANNON RIVERS.

The above-named rivers have been in my charge but a few months, and I therefore submit the following report on the obstructions in these streams, which has been prepared by Mr. B. F. Thom as, assistant engineer, who has been in local charge of the works of improvement on the first and third; there are no artificial obstructions on the portion of the Buckhannon River that is under improvement.

REPORT OF MR. B. F. THOMAS, ASSISTANT ENGINEER.

BIG SANDY RIVER.

The bridge of the Chesapeake and Ohio Railroad, crossing this river 1 mile above its junction with the Ohio, has three spans, respectively 205, 209, and 203 feet, counting from the Kentucky or western side of the river. At the time of the construction of this bridge the river occupied the central span, but it soon changed to the eastern or West Virginia side, where it has been constantly cutting away the shore and endangering the land pier, until the company has been compelled to protect it by piles, cribs, and riprap extending to the water's edge.

The former channel-span has filled with sand from 2 to 6 feet in depth, so that in ordinary low water boats have to use the new channel. The second pier from the eastern side, being the one immediately adjoining the new channel, has settled somewhat, and the company in repairing it has left piles and riprap around it extending into the channel and making navigation difficult at low stages, but not dangerous except for tows which rarely run at this stage of water. When there is a towing stage of water the original channel-span can generally be used.

The piles and riprap about this pier should be removed, as the clear width of the present low water is only 65 feet. In times of very high water the bridge itself, though 73 feet above low water, prevents boats from making their regular trips for a few days at a time, and it is probable that as soon as the river is locked and dammed and commerce increased, steps will have to be taken to remove this cause of delay.

LOUISA FORK, BIG SANDY RIVER.

The Chattaroi Railway Bridge crosses this fork, 2¼ miles above its mouth, at Louisa. It has a channel space of 175 feet, 66 feet above low water. It is not an obstruction to navigation except in extreme high water, and then only for a few hours. With the completion of the dam at Louisa, and the consequent increase of navigation in this pool, it is likely to become a more serious obstruction.

TUG FORK, BIG SANDY RIVER.

There are no bridges on this stream, but the little mill-dams on the upper part of it have been a source of annoyance and loss to timbermen for years. They have been built without authority from State or nation. Many of them have been modified the present season by order of Major Post, and quite a number destroyed, so that unless they are rebuilt by their owners, a thing highly probable, it is believed that the river can be safely navigated.

These dams are constructed of bowlders raked up in the shoals, and any one can have a dam who cares to spend a week in its construction.

GUYANDOTTE RIVER.

There are two bridges across this stream near its mouth.

The suspension bridge, owned by the county, has a clear span between tops of piers of 458 feet, with a height of 54 feet above low water, and an additional span on its upper or eastern end of 131 feet. No steam-boats run on this steam, and the bridge is an obstruction only in times of running ice, when its position, within a few hundred feet of the Ohio River, prevents the use of the Guyandotte for an ice-harbor.

The Chesapeake and Ohio Railroad bridge, 1 mile from the Ohio River, has three spans, respectively 155, 156, and 148 feet between centers, commencing at its lower or western end. The channel-span is 57 feet above low water. The axis of the bridge makes an angle of 45 degrees with the course of the stream. As the navigation at present does not include steam-boats, this bridge does not interfere with its safety.

The upper part of the river is obstructed somewhat by dams, which, as they were built under State authority, cannot be removed without purchase.

LITTLE KANAWHA RIVER.

This stream has two bridges crossing it close to its mouth in the city of Parkersburgh, both of which interfere with navigation. The Ohio River Railroad bridge, 400 feet above its junction with the Ohio River, has a channel-span of 300 feet, and is 60 feet above low water. The Wood County wagon bridge has also a channel-span of 300 feet and is 43 feet above low water. The principal objection to both bridges is that they destroy a most excellent and useful ice-harbor for Ohio River steam-boats. The county bridge has the additional objection that it prevents Little Kanawha boats from reaching the Ohio River and the wharf boat during ordinary high water, on account of its small elevation above boating stage.

Respectfully submitted.

WM. E. MERRILL,
Lieut. Col. Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., August 8, 1887.

SIR: In compliance with the provisions of section 4 of the river and harbor act approved August 5, 1886, I have the honor to report that there are two cases in this district where "bridges, causeways, or structures now erected or in process of erection do or will interfere with free and safe navigation."

First. The railroad bridge now being erected over St. Mary's Falls Canal by the Sault Ste. Marie Bridge Company.

There can be no doubt but this bridge will interfere somewhat with the free navigation of the canal, but will probably not render it any more unsafe.

The bridge is constructing under authority of an act entitled "An act to authorize the construction of a railroad bridge across the Sainte Marie River," approved July 8, 1882.

Although the bridge belongs to a private corporation its operation should be under the sole control of the canal management, with a view to reducing to a minimum the delays both to trains and vessels.

Second. A draw-bridge over the river Rouge at the crossing of the river road (Monroe road).

This bridge rests upon piles, the draw-span being insufficient to permit free and safe navigation. Moreover the draw-span is so much out of order that it cannot be used. Fortunately it has fallen down, thus rendering available for purposes of navigation the entire width of the opening, but at the same time impassable as a roadway. The responsibility for the bridge is in dispute between the townships of Springwells and Ecorse, of which the river forms the common boundary. Each township has posted a notice at its own end of the bridge denying responsibility, and there the matter rests for the present.

I am, sir, very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CARL F. PALFREY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Oswego, N. Y., November 11, 1887.

GENERAL: In compliance with General Orders No. 7, current series, Headquarters Corps of Engineers, I have the honor to report the following structures interfering with free navigation of the harbors under my charge:

AT OSWEGO, NEW YORK.

During the year 1883 the Delaware, Lackawanna and Western Railroad Company, or other parties, constructed, in the new harbor formed by the west breakwater, a pier carrying a coal trestle. The pier and trestle is about 1,000 feet in length, extending to within 407 feet of the west breakwater, and located with its outer end in about 17½ feet of water at the lowest stage of the lake. The right to so occupy the harbor was questioned by the United States, and the subject was placed in the hands of the United States district attorney. This office has no further record of action in the matter. It has been frequently reported to me by tug masters that tows easily handled in the broad spaces east and west of the coal trestle gave difficulty in passing around it.

AT CHARLOTTE, NEW YORK.

A railroad draw-bridge over the Genesee River, built by authority of Congress, now owned and used by the Rome, Watertown and Ogdensburgh Railroad, having one span of 130 feet in deep water and one of 130 feet in shallow water, offers, as usually managed during the season of navigation, as little obstruction to commerce as is consistent with its use. At about the opening of the present navigation season complaints were made to this office of difficulty and delay in consequence of refusal to open the draw.

No other structure in any degree interfering with free navigation of the harbors under my charge is known to me.

I have the honor to be, very respectfully, your obedient servant,

CARL F. PALFREY,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF COLONEL G. H. MENDELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., June 15, 1887.

SIR: The following report is respectfully submitted in regard to Oakland Harbor, the only case coming within the provisions of General Orders No. 7, Headquarters Corps of Engineers, June 2, 1887:

There are two bridges over the channel of Oakland Harbor, neither of which at present can be regarded as an interference with free and safe navigation. It is altogether probable, however, that at a future date, when the harbor improvements shall have been considerably advanced, both bridges will be an interference with navigation, which may then be obviated by a sufficient increase of space in the draws.

The Webster Street Bridge, bearing a highway and a railroad, has an opening of draw 82 feet in the clear. The Alice Street Bridge has a draw opening of 79 feet. The depth in channel above these bridges admits now only vessels of light draught, which have no difficulty in passing through the draws. When the time shall arrive for passage of large vessels the openings will be found insufficient, and will need to be increased to 150 feet, more or less.

The Alice Street Bridge is used for rail traffic solely. Both bridges were built within the past seventeen years, the Alice Street Bridge bearing a date several years later than the Webster Street Bridge.

The bridges are of wood, and are not costly structures. The draw of the Webster Street Bridge is, however, of iron or steel.

Very respectfully, your obedient servant,

G. H. MENDELL,
Colonel, Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., August 26, 1887.

SIR: In accordance with instructions contained in General Orders No. 7, current series, from Headquarters Corps of Engineers, regarding obstructions in navigable waters, I have the honor to transmit herewith a map of a portion of San Diego Harbor, showing wharves constructed along that front and also proposed constructions.

The increase in the commerce of this harbor has caused a demand for additional wharfage facilities, in consequence of which an extensive wharf has been erected by Babcock & Story, and others are projected that will tend to obstruct the free and safe navigation of the harbor. The sketch herewith gives the location of the wharves now built, and, in addition to those marked as projected, others are in contemplation at various points along the city front.

The wharves and slips are built in such a manner as to interfere with the free flow of the water, and extend out to a depth greatly in excess of that actually required in the interests of commerce and what can be carried over the bar.

Suit was recently brought in a justice's court against Babcock & Story, under a State law, for obstructing navigation, which resulted in a verdict against them and a fine of $100 imposed. This was paid, but no further steps taken to prevent any extension or addition to the structure. It is understood that the wharf will be extended as indicated on the map.

It is desirable that steps be taken to limit the length of the structures and to prescribe the manner in which they shall be built, to the end that the navigation of the harbor may not be obstructed.

I have no survey of this locality that would enable me to report what the actual effect of the wharves already constructed has been, but it is desirable in the interest of navigation that these surveys be made and repeated from time to time to ascertain the changes that take place attributable to these and other constructions.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN WILLARD YOUNG, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, July 20, 1887.

SIR: I have the honor to report that the only structures in the engineer district with which I am connected, now erected or in the process of erection, which do or will interfere with free and safe navigation are those described in Captain Powell's report on the subject, dated January 7, 1887.

The log-boom at Coquille City, Oregon, has been extended by the addition of a "catch-boom," and connected with this, at times, is a string of boom-sticks stretching right across the river. The master of the river steamer *Little Annie* complains, in writing, of this boom, saying that he carries the United States mail, and that he has been stopped as much as two hours trying to get by the boom.

The superintendent of the Government work states that cutting of the left bank opposite the boom is recent. Complaint is also made that the boom about 2 miles above Parkersburgh, on the Coquille River, has been extended out into the channel so as to make it difficult for boats to pass.

In this connection it may be well to call attention to the fact that trees have been felled directly into the Coquille River by settlers along its banks, and that, too, quite recently. This practice is to be regretted, as it directly tends to destroy existing channels, and thus to interfere with the free and safe navigation of the river.

Very respectfully, your obedient servant,

W. YOUNG,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CHARLES F. POWELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, August 22, 1887.

SIR: I have the honor to make the following report concerning certain structures, now erected or in process of erection, which interfere, or will interfere, with free and safe navigation.

The salmon pound-nets near the mouth of the Columbia River and fish-wheels next below the Cascades Canal, described, with statements of their effect on navigation, in my report of January 7, 1887, and published in Senate Ex. Doc. 105, Forty-ninth Congress, first session, are in more extensive use than formerly. It is understood that there are over a hundred pounds in Baker's Bay; they occupy the greater part of that water, leaving only a comparatively narrow passage-way for vessels. A special report of the effect of these structures on the bay channel leading to Fort Canby was submitted January 4, 1887, and a draft of proposed regulations for the location of these and similar structures was prepared in accordance with instructions and forwarded March 10, 1887.

Besides interfering with free and safe navigation, the pounds to some degree cause a shoaling; they are, in effect, permeable dikes, which check the current and cause more or less of a fill; they contract the water-way and deflect the current. Wherever the channel is good enough this contraction and deflection are unnecessary and apt to be injurious to navigation. On the other hand, where the channel is not good, the pounds, which are a strong kind of fish-trap, may be arranged to improve it, and at such places be on the whole a benefit to navigation. The location of these and similar structures, consequently, ought to be regulated for the protection and amelioration of navigable waters, and preferably by the War Department, which is charged with the execution and maintenance of works for the objects named, and which has agents in direct supervision of such works.

No authority is exercised or delegated by Oregon or Washington Territory in locating or limiting fish-pounds, traps, or wheels. Existing laws concern size of openings and times of use of traps. Structures named are built as a right of the land-owners, the same as a public wharf or landing pier would be.

The waters are public property. Bridges and the location of wharves generally are regulated, but they are for use of the public, while fish-traps, of which fish-pounds are one kind, and fish-wheels are wholly private.

Some of the Cascades fish-wheels are fixed structures of cribs and rough stone walls; others are floating. They are generally located on the low sharp points which help to form the rapids, and all of them have runs, or chutes, and sometimes wings, partly made by building walls of riprap in the river bed.

The fish-wheel structures decrease the river cross-sections, and consequently injuriously affect the current at the rapids, although not to a large degree. The removal of the fish-trap structure from along the channel shores will be advisable when this part of the river becomes navigated, and be necessary when the work of a radical open-river improvement is undertaken, as contemplated by the Cascades Canal project.

Very respectfully, your obedient servant,

CHAS. F. POWELL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR W. A. JONES, CORPS OF ENGINEERS.

DECEMBER 14, 1886.

SIR: I have the honor to report as follows upon the bridge now in course of construction across the Willamette River, Portland, Oregon:

THE RECORD.

With some minor changes which do not materially affect the main proposition as to whether or not it is an obstruction to navigation, this is the same bridge which gave rise to the extensive discussion to be found in Annual Report Chief of Engineers, 1880, Vol. III, p. 2043; also Senate Ex. Doc. 162, Forty-seventh Congress, first session.

This discussion shows conclusively that the bridge as then projected would be a serious obstruction to navigation.

The pier foundations up to low water were built before the bridge was enjoined, and subsequent events have proved that they alone have practically cut the harbor of Portland in two. The deep-water ship as a rule no longer goes above the line of the piers in place.

* * * * * * *

LOCATION.

Inasmuch as the present location is identical with the one before the United States circuit court, and inasmuch as the court therein held, "Upon the evidence and in the very nature of things there can be no doubt that the bridge where and as it is being constructed is a serious obstruction to the navigation of the river," it will not be necessary for me to touch upon the question of location.

CHARACTER OF THE PRESENT BRIDGE.

The bridge now in course of construction differs from the one before the United States court in this:

That the draw openings have been increased to 136 feet at the low-water line. They were 100 feet in the enjoined bridge. The pivot pier remains the same. The other clear spans and abutment spans have been changed and are as follows, commencing from the Morrison street approach:

	Width (in feet).	
	Original.	Present.
Shore span, west side	135	161
Swing opening, C to C of piers	130	154
Swing opening in the clear between masonry of piers	100	136¼
Three closed spans, C to C of piers, each		262

The bridge is a combination truss-pivot draw-bridge. The draw and draw-rest piers are of stone, laid on a pile and grillage foundation incased in cribs filled with riprap stone.

The remaining piers are iron tubes 5 feet in diameter, in pairs, and filled with concrete. These rest on foundations similar to those of the draw-piers. I have not the dimensions of these cribs, but they are an important factor in any discussion of the effect of the bridge upon the regimen of the river. The clear headway of the bridge is about 8 feet at high water. The character of the bridge trusses is not material to the discussion. It will be seen that the short pile bents running out from the eastern shore have been replaced with trussed spans of considerable dimensions. These rest on tubular piers 5 feet in diameter. The stationary spans are now of sufficient dimensions. The superfluous pier foundations have, I understand, been removed, but I am not informed as to whether sufficiently so or not.

The width of the draw opening measured parallel to the axis of the bridge is, as stated, 136 feet at low water. But the effective draw opening for a passing vessel is a function of the direction of the current through said opening. The chart submitted shows that this direction is continually varying with changes in the river stages. It shows a current direction through the draw at a stage, when the velocity is very great, that varies from the direction of a line parallel with the piers at an angle of 20 degrees. The effective width of the draw opening is its width at right angles to the current passing through it. Hence the record shows that the effective width of the draw opening became reduced at a season of great commercial activity to 121 and possibly 115 feet, and this when the river velocity was so great as of itself alone to render navigation difficult. No rest piers for the open draw and no sheer booms are provided.

There are submitted herewith:

Two maps of the river, showing soundings and position of piers.

Map showing currents and piers.

A projection showing effective width of draw opening at greatest angle of current.

* * * * * * *

Very respectfully, your obedient servant,

W. A. JONES,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

APPENDIX X X.

OCCUPANCY AND INJURY TO PUBLIC WORKS BY CORPORATIONS AND INDIVIDUALS.

LETTER OF THE SECRETARY OF WAR.

WAR DEPARTMENT,
Washington City, February 26, 1885.

The Secretary of War has the honor to transmit to the House of Representatives copies of reports of such officers in charge of river and harbor districts as report instances in which piers, breakwaters, or other structures or works built or made by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or an individual, and the extent and mode of such use, occupation, or injury, and the facts touching the same; said reports being transmitted in compliance with the requirements of section 2 of the river and harbor act of July 5, 1884.

ROBERT T. LINCOLN,
Secretary of War.

The SPEAKER OF THE HOUSE OF REPRESENTATIVES.

LETTER OF THE CHIEF OF ENGINEERS.

OFFICE OF THE CHIEF OF ENGINEERS,
UNITED STATES ARMY,
Washington, D. C., February 24, 1885.

SIR: Section 2 of the river and harbor act of July 5, 1884, requires of the Secretary of War that—

> He shall * * * report to Congress, at its next session, all the instances in the United States in which piers, breakwaters, or other structures or works built or made by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or an individual, and the extent and mode of such use, occupation, or injury, and the facts touching the same.

With a view to the collection of data to supply the information desired, all officers under the direction of this office were instructed to prepare and submit detailed reports covering all facts necessary to enable the Secretary of War to comply with the terms of the extract above quoted. Reports have been received from all officers in charge of river and harbor districts, and I have the honor to submit herewith copies of such of them as report instances "in which piers, breakwaters, or other structures or works built or made by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or an individual," etc. All the other officers state that there are in their districts no instances of such use, occupation, or injury to report under the provisions of the act.

Very respectfully, your obedient servant,

JOHN G. PARKE,
Acting Chief of Engineers.

Hon. ROBERT T. LINCOLN,
Secretary of War.

REPORT OF LIEUTENANT-COLONEL GEORGE H. ELLIOT, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, R. I., February 11, 1885.

GENERAL: In compliance with Department letter of February 10, 1885, I have to state that there is no structure or work in my district "built or made by the United States in aid of commerce or navigation, used, occupied, or injured by any corporation or individual."

The Government wharf in the inner harbor at Block Island is the only wharf on the island. It is used by the General Government and the public in common, and it is supposed that it is not included in the works referred to in the first part of section 2 of the act of July 5, 1884.

Very respectfully, your obedient servant,

GEORGE H. ELLIOT,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL WALTER McFARLAND, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New Haven, Conn., January 14, 1885.

GENERAL: Under section 2 of the act of Congress relating to rivers and harbors, approved July 5, 1884, I have the honor to report as follows upon the use by corporations or individuals of "works built or made by the United States in aid of commerce or navigation," * * * all in the engineer district of which I have charge, extending from the headwaters of the Hudson River to the eastern end of Long Island Sound.

Very respectfully, your obedient servant,

WALTER McFARLAND,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT UPON THE USE, OCCUPATION, OR INJURY BY CORPORATIONS OR INDIVIDUALS OF PIERS, BREAKWATERS, OR OTHER STRUCTURES OR WORKS BUILT OR MADE BY THE UNITED STATES IN AID OF COMMERCE OR NAVIGATION, OCCURRING OR EXISTING IN THE ENGINEER DISTRICT EXTENDING FROM HEADWATERS OF THE HUDSON RIVER TO THE EASTERN END OF LONG ISLAND SOUND.

ENGINEER OFFICE, UNITED STATES ARMY,
New Haven, Conn., December 31, 1884.

The only instances of the * * * kind in this district are found in connection with the dikes on the Upper Hudson.

1. Miller and Whitebeck have built a dock over 273 feet of the half dike at Mull's Island, on the east side of the river, about 13 miles below the railroad bridge at Albany. The dike just above the dock has been heavily loaded with stone to serve as an ice-breaker, and shows signs of giving away under the weight imposed on it. This occupation of the dike was authorized by the Hon. Secretary of War, November 9, 1880, under an opinion of the Judge-Advocate-General of the Army.

2. H. Slingerland has built a dock over 103 feet of the Barren Island Dike opposite Coeyman's, on the west side of the river, about 12½ miles below the railroad bridge at Albany. It is not known under what authority this was done.

3. The Knickerbocker Ice Company occupy with their wharf 319 feet of the Roah Hook Dike, on the west side of the Hudson River, about 12 miles below the railroad bridge at Albany, by authority of the Chief of Engineers, under the opinion of the Judge-Advocate-General of the Army before referred to, October 12, 1880.

4. F. E. Bean uses for a dock 259 feet of the Castleton Dike, on the east side of the river, about 9 miles below the Albany Railroad Bridge. The dike is much broken for about 20 feet above the upper end of the dock. This occupancy is under authority of a grant of lands under water, by the State of New York, over which this United States Dike is built.

5. E. P. Stimson occupies for dock purposes 280 feet of the Castleton Dike, about 400 yards above the part occupied by F. E. Bean, under approval of the Chief of Engineers, dated September 11, 1871. The dock is not now used and has fallen into decay.

6. The Ridgewood Ice Company occupy the lower end of the Cedar Hill Dike, on the west side of the river opposite Castleton, about 8½ miles below the railroad bridge at Albany, under authority of a grant of lands under water, made by the State of New York, upon which this United States Dike is built.

7. Richard English occupies for dock purposes 203 feet of the Campbell Island half dike, on the east side of the river, about 7½ miles below the railroad bridge at Albany, under authority of a grant of land under water from the State of New York, this dike being built over that land.

8. Hotaling and Park, now Knickerbocker Ice Company, occupy a part of the old Beacon Island half dike, on the west side of the river, about 3½ miles below the railroad bridge at Albany, under what authority is not known. Their occupancy of it has, however, improved it, as they have closed a break which formerly existed in it.

9. John Patterson has built a dock 100 feet long over the old revetment of Beacon Island, on the west side of the Hudson, about 600 yards above Hotaling and Park's ice-house, under approval of the Chief of Engineers, dated December 16, 1881.

10. Paul S. Forbes has built a dock over a part of the Bath Dike, on

the east side of the river, about 1½ miles above the lower railroad bridge at Albany, under agreement and bond transmitted to the Chief of Engineers October 28, 1876. The dock has not been kept in repair and the dike has given away under it.

11. W. H. Forbes has extended the dock built by Paul S. Forbes, about 225 feet further north, over the Bath Dike. The occupation of this dike was approved by the honorable Secretary of War, June 15, 1882.

12. George Mark and others have built a dock over the old revetment of Patroon's Island, on the west side of the river, about 2½ miles above the lower railroad bridge at Albany, extending out into the river about 60 feet beyond mean high-water mark, without any authority other than that derived from the old colonial grant to the Patroon.

13. Erastus Corning has occupied for dock purposes 105 feet of the high dike between Hillhouse and Patroon Island, on the west side of the river, about 3½ miles above the lower railroad bridge at Albany, under authority of the honorable Secretary of War, dated June 15, 1882.

14. Corning and Company, under authority of a grant of lands under water from the State of New York, have for some years been filling in with ashes and slag from their works, a strip of this grant running south from their iron works, on the east shore of the river, just below Troy. They have gone outside the limits of their grant in some places, and none of the material dumped having any protection against the action of the current, much of it is carried away, especially during freshets, and is dropped in the channels which have been under improvement by the United States.

* * * * * * *

Respectfully submitted.

WALTER MCFARLAND,
Lieut.-Col. of Engineers.

REPORT OF MAJOR W. H. HEUER, CORPS OF ENGINEERS.

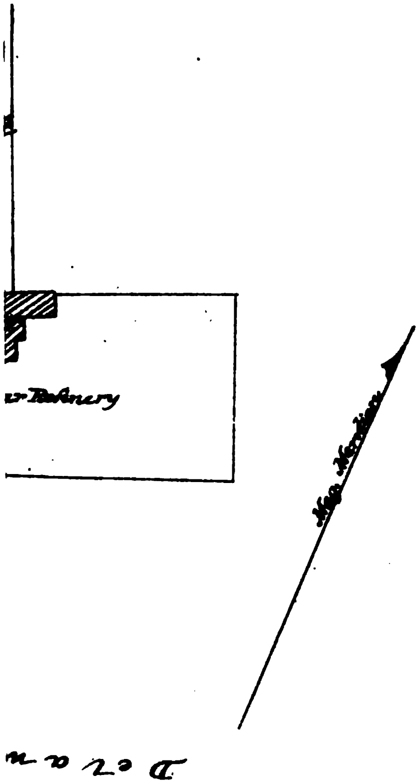
PHILADELPHIA, PA., *October* 6, 1884.

SIR: In compliance with the requirements of General Orders, No. 13, Headquarters Corps of Engineers, United States Army, July 23, 1884, relative to the use, occupation, or injury by individuals or corporations, of piers, breakwaters, or other structures or works made or built by the United States, etc., I have the honor to submit the following final report:

With the exception of those at Chester, Pa., Marcus Hook, Pa., and the Delaware Breakwater Harbor, Delaware, there are no public works in this district which are used or occupied by an individual or corporation.

The works at Chester, Pa., comprise two lines of piers extending into the Delaware River. The interval between the two works is less than 700 feet, forming a harbor for the protection of shipping against running ice.

The upper line of piers, which are on a prolongation of Market street, are and have been for many years the principal landing point at Chester, and during the last season no less than nine steam-boats made landings at these piers daily, stopping only long enough to let passengers on and off.

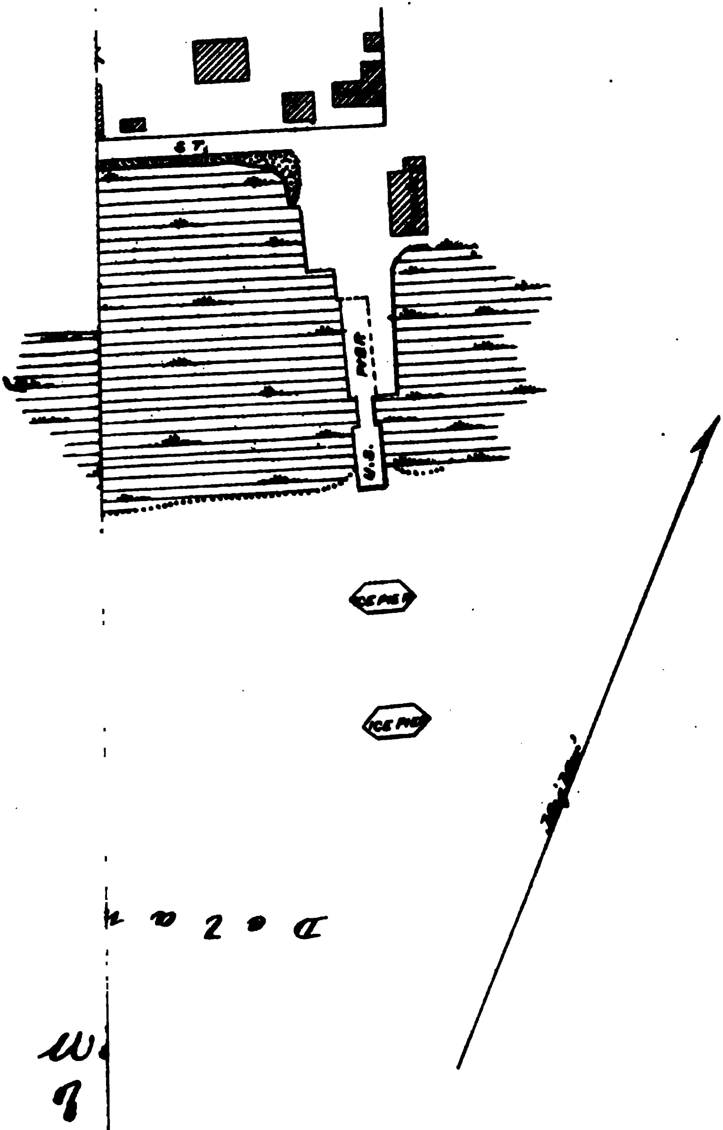


Philada

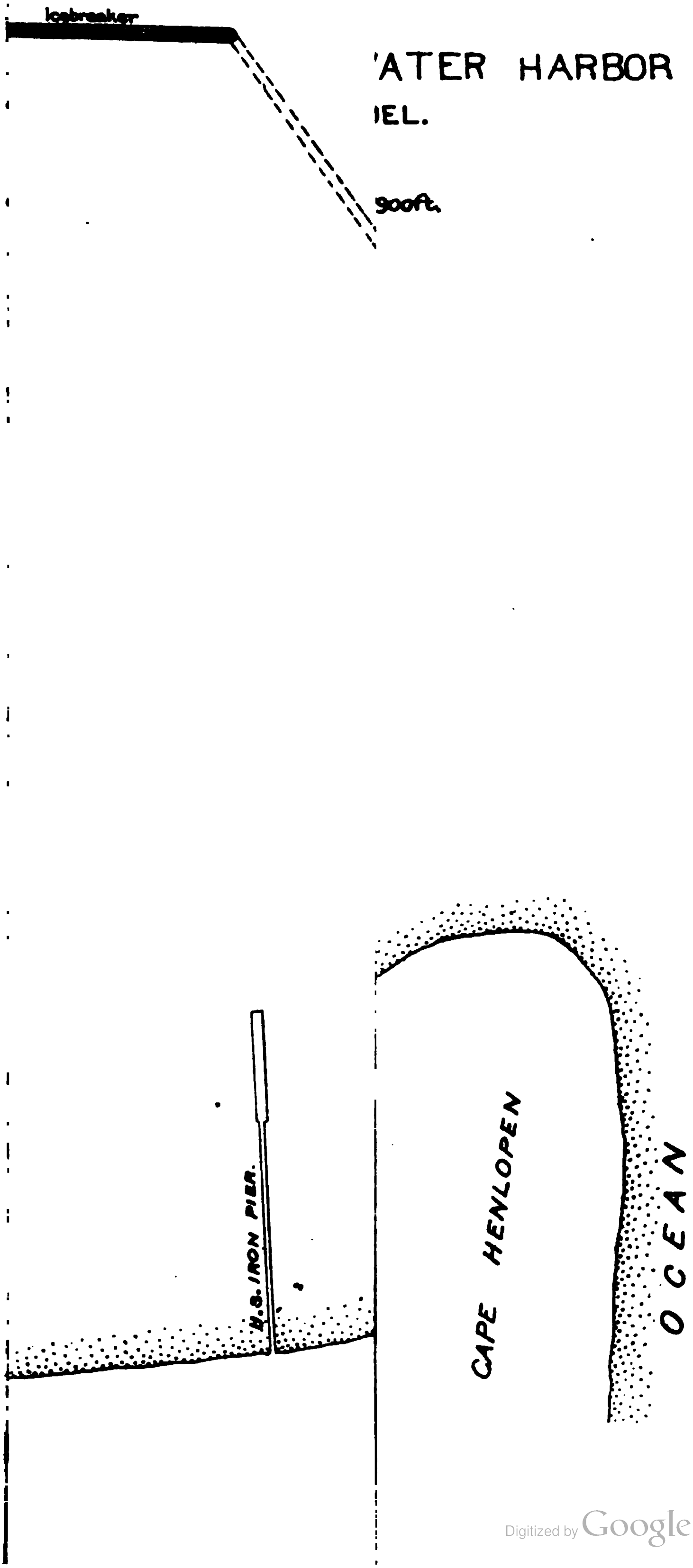
With report of
of Engineers.

(Sig

Eng50 2



Eng50


Icebreaker
'ATER HARBOR
)EL.
900ft.
U.S. IRON PIER
CAPE HENLOPEN
OCEAN

The injury received by the piers in their use by the steam-boats is promptly met by liberal expenditures for repairs when required, as was the case during the present season, when suitable repairs amounting to about $300 were applied to the outermost pier at Market street.

In 1882, a small frame building about 50 feet long and 20 feet wide, for the use principally of passengers waiting for boats, was erected by Mr. R. A. Torrance, on the west side of the approach to the piers. The east side of the building covers about 8 inches in width of the Government property for its entire length, and the authority to occupy the same was granted by the Chief of Engineers in June, 1882, upon the recommendation of Maj. William Ludlow, Corps of Engineers. The locality of the building is indicated on a sketch of Chester Harbor herewith.

The piers on the lower line, on a prolongation of Edgemont street, access to which is gained along a narrow causeway, also the property of the United States, is occasionally used in landing lumber, which, as a general rule, is immediately transported to the yards of the owners of the same.

In 1874, by authority of the mayor and council of Chester, the Chester and Delaware River Railroad Company constructed their railroad, crossing the Government causeway about 650 feet north from the head of the pier on the Delaware front. The reference of the railroad and causeway at their intersection being about equal, causes no inconvenience in passing to and fro along the causeway.

The works at Marcus Hook, Pa., consist of two landing piers of wood with earth filling and six detached piers of stones complete, and one under process of construction, forming an ice-harber at that locality. The old ship *Roanoke*, formerly a triple-turreted war vessel, has occupied the berth at the head of the lower United States landing pier since April 10, 1884, by authority of the Secretary of War, through the Chief of Engineers, on the recommendation of First Lieut. Thomas L. Casey.

The upper landing pier is used merely to touch at by two small steamboats plying between Philadelphia and Wilmington, Del., to land and receive passengers.

At the Delaware Breakwater Harbor, near Lewes, Del., there are two detached works of stones, called the "Breakwater" and "Ice-Breaker," respectively, forming a harbor of refuge for vessels.

From the shore, extending out into the harbor, an iron landing pier has been constructed.

The Western Union Telegraph Company have a telegraph station on the breakwater, which was established in 1875, by authority of the Secretary of War.

No individual or corporation is occupying any part of the iron pier, Mr. William B. Yardley, the person referred to in my report of August 5, 1884, as having coal stored thereon, having removed the same.

* * * * * * *

Transmitted herewith are sketches of the works at Chester, Pa., Marcus Hook, Pa., and Delaware Breakwater Harbor, Delaware.

Very respectfully, your obedient servant,

W. H. HEUER,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.
(Through Lieut. Col. William P. Craighill, Corps of Engineers, supervising engineer.)

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., October 9, 1884.

Respectfully forwarded to the Chief of Engineers.

It is supposed the authority of the Chief of Engineers for the occupation of a small part of the United States property at Chester, Pa., by a frame building contained a provision for its removal, if necessary.

Is not the crossing of the United States causeway at Chester by the Chesapeake and Delaware River Railroad a trespass, technically at least, as being without proper authority?

May not its unchallenged continuance give a legal right of occupation adverse to that of the United States?

Is the authority for the use of the Delaware Breakwater as a station of a telegraph company sufficient under the existing interpretation of law?

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., October 30, 1884.

GENERAL: In compliance with the instructions of General Orders, No. 13, July 23, 1884, Headquarters Corps of Engineers, I have the honor to submit the following "final report" on the subject therein referred to:

GREAT KANAWHA RIVER, WEST VIRGINIA.

The United States land at lock and dam site 6, abutment side, has been for more than two years without proper authority crossed by the track of the Ohio Central Railroad Company, which extends from Charleston along the right bank of the Kanawha River to its mouth.

While this is technically a trespass no injury has thus far resulted to the United States. It is supposed the crossing can only be authorized by Congress. The railroad is now in the hands of a receiver. The attorneys promise to make an effort to obtain from Congress at the next session proper authority for the crossing. Meanwhile there is no necessity for a removal of the track.

* * * * * * *

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., October 31, 1884.

GENERAL: In accordance with General Orders, No. 13, Headquarters Corps of Engineers, United States Army, current series, relative to section 2 * * * of the act of July 5, 1884, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, I have the honor to submit the following final report on all the matters known to me in this district covered by the foregoing.

* * * * * * *

The following case is reported, as it is understood that my instructions cover it:

The light-house site in this harbor at Lambert's Point (see accompanying map) is "used and occupied" to a certain extent by the pier of the Norfolk and Western Railroad Company, that extends from the mainland out to the light-house. It is further understood that this has been done by permission of the proper authority, and that the property is not "injured" thereby.

Very respectfully, your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Savannah, Ga., January 19, 1885.

GENERAL: In compliance with the provisions of the second and third clauses of section 2 of the last river and harbor act, promulgated in General Orders No. 13, headquarters Chief Engineers, U. S. A., Washington, D. C., July 23, 1884, I have the honor to report as follows:

* * * * * * *

In the Savannah River contractors and other persons have been permitted to tie up boats alongside of the garden-bank wing-dams when not in the way of United States plant, boats, etc.

A slight injury to one of the dams by the contractor's plant will be repaired at once. The dams referred to are opposite the city of Savannah.

* * * * * * *

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

General JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF CAPTAIN WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., January 20, 1885.

GENERAL: I have the honor to report, in obedience to General Orders, No. 13, headquarters Corps of Engineers, U. S. A., Washington, D. C., July 23, 1884, that in only one instance have any of the structures or works built by the United States in aid of commerce or navigation in the district under my charge been occupied by any corporation or individual.

At the east jetty at Volusia Bar, Saint John's River, Florida, piles have been driven and a dwelling and wharf have been built by a Mr. Falana. The house is occupied by him, and he is employed by the steam-boat lines to keep lights for the benefit of navigation. I regard this as an advantage to commerce.

* * * * * * *

Very respectfully, your obedient servant,

WM. T. ROSSELL,
Captain of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., February 17, 1885.

SIR: In reply to your letter of the 13th instant requiring information as to construction, use, injury, etc., of works constructed by the United States Government in my district, I would respectfully state that there is only one instance of the kind that has come to my knowledge.

In January, 1883, Fair Slough, on the Lower Pearl River, Mississippi, was closed by Maj. Amos Stickney, Corps of Engineers, U. S. Army, by driving piles across the upper mouth in order to confine all the water in one channel.

During the months of December, 1884, and January, 1885, Mr. Weston, a mill-owner at Logtown, Miss., removed the piling by blasting, so as to open the slough for logs to his mill.

It has been reported that since the opening of this slough that portion of the main river cut off by the slough, about 5 miles, has shoaled considerably, as it is estimated that fully one-half of the volume of water goes through the slough, returning, however, to the main river near Mr. Weston's mill.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR AMOS STICKNEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., August 5, 1884.

GENERAL: In compliance with requirements of General Orders, No. 13, dated headquarters Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to report that the levees built by the United States in the district under my charge are injured by individuals who use them for highways, and thus wear them down, cut the sod covering, and cause the earth to wash down. It is a difficult matter to prevent this traveling, especially in the wet season. Some of the parishes have laws forbidding travel on the levees, but they are so little observed or enforced that they do not prevent the injury stated. A national law, with sufficient penalty for violation, would probably have a good effect, even if it did not entirely stop the injury.

A copy of report of Assistant Engineer H. S. Douglas is transmitted herewith. River gauges set up at various points are quite frequently knocked down by steam-boats. Sometimes this is accidental, but often it is caused by carelessness. In clear cases of carelessness a suspension of license of captain or pilot might have a salutary effect, and compel more respect from such parties. I know of no other instances where structures, under my charge, built by the United States in aid of commerce or navigation, are used, occupied, or injured by corporations or individuals.

Very respectfully, your obedient servant,

AMOS STICKNEY,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. H. S. DOUGLAS, ASSISTANT ENGINEER.

UNITED STATES ENGINEER OFFICE,
New Orleans, La., July 30, 1884.

MAJOR: In obedience to your verbal instructions, I have the honor to submit the following report on the injuries done to levees built by the United States for the improvement of navigation on the Mississippi River, fourth district. The injury consists in the use of the levees as road or highways, by which they are worn down below the established grade. The result is that a flood, which might be resisted otherwise, goes over the top and the levee is washed away or badly broken. A heavy expense is thus entailed either to maintain the levee at a proper grade or to rebuild it after it has been destroyed. The injury is done by the resident community, and is not confined to any particular individual. The public roads generally run immediately behind the levees, and in the winter season, when these roads become bad, the top of the levee being high and well drained, is utilized as a road by all whose business or inclination cause them to pass that way. In certain localities, where the levee is built through a swamp, it is the only road, and no effort is made to travel or haul except on its top. Some of the parishes in which the Government levees are situated have laws to prevent travel on top of the levees, but as these parishes seldom keep their roads in a passable condition the law is never enforced. The particular Government levees at present suffering injury from this cause are, Pointe Coupée Levee, Hog Point to Raccouri Levee, and Atchafalaya River to Red River Landing Levee, in Pointe Coupée Parish, Green's to Fairview Levee, and Lake Concordia Levee, in Concordia Parish; Kempe Levee and Hardscrabble and Bondurant Levee, in Tensas Parish.

As the parish and State laws seem to be ineffectual some measures should be taken by the General Government to prevent injury to these expensive works.

Very respectfully, your obedient servant,

H. S. DOUGLAS,
Assistant Engineer.

Maj. AMOS STICKNEY,
Corps of Engineers, U. S. A.

REPORT OF MAJOR O. H. ERNST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., January 30, 1885.

GENERAL: In compliance with the instructions contained in General Orders, No. 13, dated Headquarters Corps of Engineers, July 22, 1884, I have the honor to report as follows upon the subjects therein referred to.

As to—

All the instances * * * in which piers, breakwaters, or other structures, or works built or made by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or an individual, and the extent and mode of such use, occupation, or injury, and the facts touching the same.

The only instance of the kind in my district is the occupation of the dike extending from the Missouri shore to Ellis Island, opposite Alton, Ill., by the Alton Harbor Company. The company, through their president, Mr. J. H. Stout, made application, under date of May 9, 1883, for authority to raise this dike, which application was forwarded by me, with the following indorsement:

UNITED STATES ENGINEER OFFICE,
Saint Louis, Mo., May 11, 1883.

Respectfully forwarded to the Chief of Engineers with the recommendation that this request be submitted to the honorable Secretary of War with favorable indorsement.

The inclosed sketch shows Alton Slough with the submergible dam, which was completed in 1875. The dam accomplished its object of preventing the channel from leaving the Alton side of Ellis Island and of deepening the channel, but it was built without reference to providing a shelter, and is not high enough to make a safe harbor below it.

The Alton Harbor Company request permission to raise the dam at their own expense.

I can see no objection to their request being granted.

The effect of raising the dam would be very beneficial to the private interests concerned, while the effect upon the main channel of the river and upon the public landing at Alton would not be great, but so far as it extended would be beneficial.

O. H. ERNST,
Major of Engineers.

By your letter of May 23, 1883, I was informed that the application had been forwarded to the honorable Secretary of War, with a favorable indorsement, and that it had been returned to your office approved.

The company subsequently raised the dike and provided for themselves a secure shelter below it.

* * * * * * *

Very respectfully, your obedient servant,

O. H. ERNST,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF MAJOR A. MACKENZIE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Rock Island, Ill., December 12, 1884.

GENERAL: General Orders, No. 13, Headquarters Corps of Engineers, current series, requires a report upon certain facts referred to by section 2 * * * of the river and harbor act of July 5, 1884.

* * * * * * *

The information asked for in connection with section 2 is desired for presentation to Congress during present session. I would, therefore, submit herewith a report upon the matters referred to in that section.

The works constructed by the United States on the Upper Mississippi in the aid of commerce and navigation consist of dams and shore protections. Piers and breakwaters, as the terms are ordinarily understood, have not as yet been built or required. Some dams have been built in the form of causeways, for reaching deep water, when the work of the Government tended to injure natural landings; but with these exceptions, no works built by the United States on the Upper Mississippi are occupied or used by corporations or individuals.

In a few cases, works constructed by the United States in aid of navigation have been slightly injured by private parties, but it has not been possible to detect the guilty persons.

* * * * * * *

Very respectfully, your obedient servant,

A. MACKENZIE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR CHARLES J. ALLEN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Saint Paul, Minn., December 1, 1884.

GENERAL: I have the honor to submit the following report in obedience to General Orders, No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, requiring information necessary to comply with the requirements of section 2 * * * of the river and harbor act of Congress approved July 5, last.

USE OR OCCUPATION OF, OR INJURY TO, WORKS BUILT OR MADE BY THE UNITED STATES IN AID OF COMMERCE OR NAVIGATION. FALLS OF SAINT ANTHONY, MINNESOTA.

The preservation of the Falls of St. Anthony was undertaken by the United States in 1870, since which time the Government has expended upon this work $600,000 in extensive and costly structures and repairs.

The plea for this expenditure was, that the destruction of the falls would be followed by destruction of navigation on the Mississippi River above them. There has not been, however, any navigation by steamboats between the falls and Saint Cloud, about 75 miles above Minneapolis, for several years past.

The principal works constructed by the Government, are:

(1) A concrete dike, about 1,870 feet in length, under the limestone bed of the river to prevent the cutting away of the soft sandstone underlying the stratum of limestone.

(2) Rolling dams, designed to maintain, during the winter season, sufficient depth of water over the limestone to prevent injurious action upon it of ice and frost.

(3) A timber apron and wing at and below the crest of the falls to prevent undermining of the sand-rock and consequent recession of the limestone ledge.

(4) A sluice at the west side of the apron for the passage of saw-logs.

For many years past the mill and water-power companies, chartered in 1857, have occupied the bed of the river above the crest of the falls by dams and other structures, for the development and use of the power of the stream, thereby contracting the water-way to about one-third its original (natural) width. The flood as well as low-water volumes are thus forced through a narrow gorge of about 450 feet width, diminishing, on account of the forced construction of the wing, to a width of 350 feet, and through a fall of 40 to 45 feet, vertical distance, the height depending upon stage of water, operation of the gates of the mills, etc.

The eroding power of volumes of water of from 5,000 to 40,000 cubic feet per second, plunging through heights of 40 to 45 feet, upon the sand-rock composing the bed of the river below the falls, is immense.

The recession of the limestone crest, from 1857 to 1868, was (measured along the axis of the stream) 325 feet.

An attempt, in 1868, by private parties to tunnel through the sand-rock under the limestone, on the east side, was followed by such disasters and breaks in the ledge that the very existence of the falls was threatened. The danger proving too formidable for individuals or corporations to cope with, the assistance of Congress was invoked.

The concrete dike and rolling dams were completed in 1876; the timber apron and wing in 1878; the log sluice was built in 1879.

The appropriations made by Congress since 1878 have been applied in repairing and strengthening the apron and wing. The log sluice was constructed under an appropriation of $10,000 specially made by act approved March 3, 1879.

Some of the dams and works pertaining to the mills are dilapidated and leaky. Should their condition not be improved there is a possibility of ice and logs going over or through them in the spring, or at times of floods, to the further detriment of the apron and east wing.

In the fall of 1881 and during the winter following J. B. Bassett, of Minneapolis, and others associated with him, deposited large quantities of rock, gravel, and earth in the main channel of the river on the west side and just above the apron. The material thus deposited was, at one point, 18 feet in height above low water, and formed an immense dike, narrowing the channel width by 118 feet. The effect of the deposit was not only to practically block the entrance to the log sluice, but also to concentrate the flow of water into the easterly angle formed by the apron and wing, the weakest and most exposed point of the works. The floods of the following spring worked great injury to the apron and wing in consequence, and extensive repairs and additions to the defensive works became necessary on the part of the Government.

During the winter of 1881 and 1882 an attempt was made by parties claiming the right to the water-power on the east side of the river to tunnel under what is known as Farnham & Lovejoy's mill-pond, at a point about 50 feet below (down-stream from) the United States works, the object being, apparently, to obtain a race under that pond. This attempt was, however, discontinued in consequence of an injunction served at the instance of Farnham & Lovejoy or by their attorney.

The tunneling, however, progressed far enough to expose a small face of the sand-rock to the action of high water, and the erosion has, since the winter of 1882, caused a recession of the limestone ledge at this point of probably 40 feet.

As this recession approaches the United States works the latter are more and more endangered.

As soon as Mr. Bassett's action was discovered he was notified to desist. As he persisted in depositing the material the case was referred to the Department of Justice, and about the 1st of April, 1882, proceedings were commenced before the United States district court to compel the removal of the material.

After the taking of long and tedious testimony the deposits were finally removed, as required, in the summer and fall of 1883. Mr. Bassett sustained some pecuniary loss in consequence of being obliged to remove the material. Beyond this nothing was done. The United States attorney in January, 1882, expressed the opinion that no action under the law could be brought against Mr. Basset, further than that necessary to compel removal of the deposits. Suit for damage was deemed out of the question, it being impracticable to prove exactly how much of the injury to the works was due directly to the deposits.

This case was reported in the Annual Reports of the Chief of Engineers for 1882 and 1883; also in special letters from this office dated February 11, 1882, and April 30, 1882.

The running of loose saw-logs in large numbers over the apron, instead of through the sluice built for the purpose of receiving the logs in order to save the apron, occurred at different times between 1880 and 1882. The logs were sheered by the Mississippi and Rum River Boom Company into the pond of the Minneapolis Mill Company. From this pond they were to be sluiced over the falls to be received by the Saint Paul Boom Company. The two companies, it appeared, differed as to the responsibility of driving the logs to the sluice; in consequence many millions of feet of logs escaped over the apron, grinding and wearing the latter in their descent. In some cases it was claimed that the booms above the falls broke under the pressure of accumulations of logs and of freshets. An injunction was finally obtained from the United States court in March, 1882, restraining the running of logs over the apron, and the agent of the Minneapolis Mill Company, about a year later, making a connection between their mill-pond and the log-sluice; no trouble of importance has since been experienced from the saw-logs.

Bearing in mind the difficulty, under the most favorable of circumstances, attending the efforts of the Government to preserve the falls, it has seemed proper to make the foregoing detailed statement.

MISSISSIPPI RIVER ABOVE THE FALLS OF SAINT ANTHONY, MINNESOTA.

From such information as I can gather, it appears that in the spring of 1875 lumbermen cut the brush and stone dams constructed by the Government for the improvement of navigation at the Thousand Islands, near Saint Cloud. The dams were broken through in order to get the logs out of the pockets formed by the dams and islands, that mode of procedure being more profitable to the lumbermen than taking the logs out in any other way.

It also appears from the records of this office that in the spring of 1878 log-drivers committed similar depredations at the dams constructed by the Government at Brown's Island, Haughton's Flats, and Lily Pond Islands. Also that the drivers pulled down several of the sign-boards placed at these dams, these sign-boards having lettered on them an extract from the act of Congress approved August 14, 1876, prescribing the penalty for such depredations.

The officer in charge, Major Farquhar, represented the matter of the damage to the work at Haughton's Flats to the Department May 21, 1878, and, at the request of the Chief of Engineers, the honorable Attorney-General, on the 3d of June, directed the United States attorney for Minnesota to examine the matter. It seems that satisfactory evidence could not be produced against the guilty parties. * * *

HARBOR OF DULUTH, MINNESOTA.

Assistant Engineer J. H. Darling reports, in relation to this harbor, as follows:

In compliance with your orders dated July 31, 1884, relating to the occupancy or injury of public works and obstructions to safe navigation, I have to report as follows:

I am not aware of any occupancy of public works in this vicinity, nor of injury to same, except as the latter is accidental, as in case of vessels striking piers during a severe storm.

* * * * * * *

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL J. W. BARLOW, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Milwaukee, Wis., November 4, 1884.

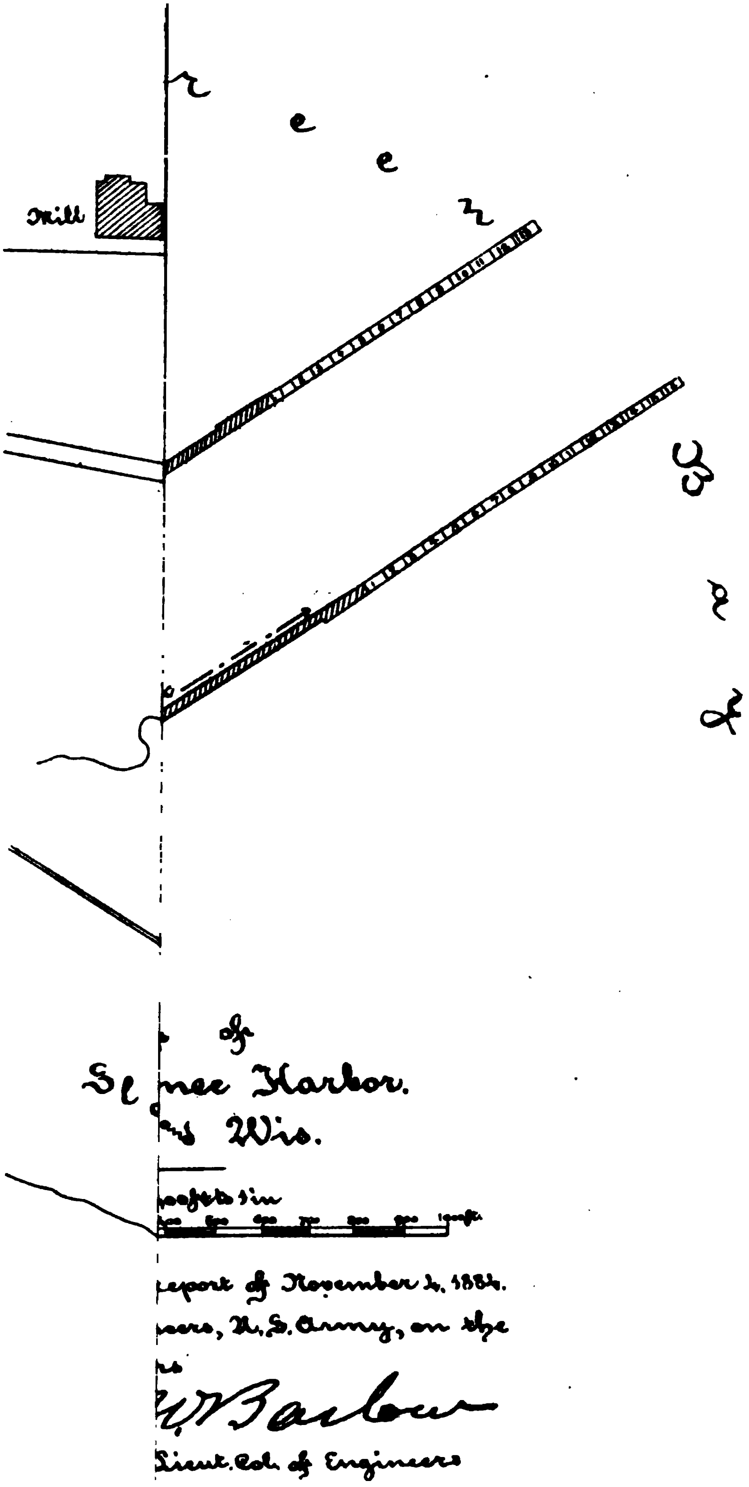
GENERAL: In compliance with instructions contained in General Order No. 13, Headquarters Corps of Engineers, United States Army, dated July 23, 1884, I have the honor to submit reports on the harbors named below, containing the information called for by section 2 * * * of the river and harbor act approved July 5, 1884:

(1) Ontonagon, Mich.; (2) Marquette, Mich.; (3) Menomonee, Mich., and Wis.; (4) Green Bay, Wis.; (5) Ahnepee, Wis.; * * *; (7) Manitowoc, Wis.; (8) Sheboygan, Wis.

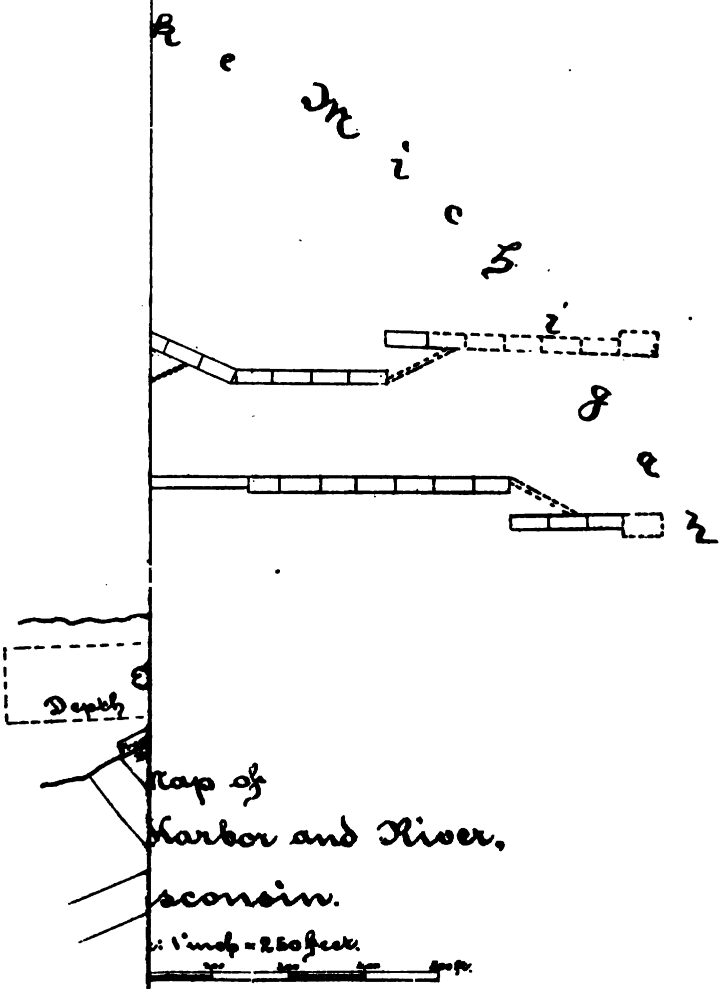
There is no occupation of the piers or other structures built by the United States, * * * as far as known, at any of the other harbors in this district.

The questions growing out of the private occupation of Government piers at many of the lake ports, which, in some instances, lead to very embarrassing complications, would seem to render immediate legislation upon this subject a matter of great importance. I would, therefore, respectfully suggest that the enactment of a suitable law be recommended, which shall clearly define the jurisdiction of the United States over piers and other works built by Congressional appropriations, and making it a penal offense for any individual or corporation to occupy or use for private or commercial purposes any such structure, without having first obtained the written authority of the Secretary of War.

It seems also advisable that such a law should contain a proviso permitting and authorizing the Secretary of War to transfer to the proper city or town authorities the control of any portion of such works, which, having become, by accretions to the shores adjacent, or from other causes, no longer a part of the necessary protection to the harbor entrance, are still essential in maintaining the inner harbor, and are also valuable for wharfage or other commercial purposes; a condition of

r
e
e
z
Mill
B
r
e
p of
nee Harbor.
s Wis.
feet = 1 in
1000 ft
eport of November 4, 1884.
neers, U.S. Army, on the
s
Barlow
Lieut. Col. of Engineers

Eng



Map of

Harbor and River,

sconsin.

: 1 inch = 250 feet.

ny report of November 2.

ef of Engineers, U.S. Army.

of piers

J. W. Barlow

Lieut. Col. of Engineers.

Eng50

such transfer being, that the works so transferred shall be kept in perpetual repair by the local authorities.

Very respectfully, your obedient servant,

J. W. BARLOW,
Lieut. Col. of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

ONTONAGON HARBOR, MICHIGAN.

The only instance at this harbor of pier occupation is that of a branch track of the Ontonagon and Brulé River Railroad having been laid for a distance of 230 feet on the inner end of the east pier. This was done to aid the contractor for pier extension in carrying on the work, and the track has never, so far as known, been used for any other purpose. * * *

MARQUETTE HARBOR, MICHIGAN.

At this harbor a considerable portion of the protected anchorage behind the breakwater is used for booming logs, the booms being attached to the breakwater.

Although this may not injure the structure, the area designed for a harbor of refuge is greatly curtailed.

MENOMONEE HARBOR, MICHIGAN AND WISCONSIN.

A report upon the occupation of the Government piers at this harbor was made by my predecessor, Lieut. Col. Henry M. Robert, Corps of Engineers, U. S. Army, under date of October 12, 1876.

Referring to the inner or slab portion of the north pier, this report states:

> This portion of the north pier was cut off from the river channel, and would soon be cut off from the bay also. Under these circumstances it became inclosed by the property of the R. Stephenson & Co.'s saw-mill, and I told the company that I had no objection to their using it as long as their property was in such a shape as to prevent the bay breaking into the river.

This part of the Government pier had been built in 1872, and subsequently became inclosed by improvements made by the saw-mill company. Still later, the space north of this slab pier was reclaimed by filling in with slabs, saw-dust, etc., the work being done by the mill company, thus effectually protecting the lake side of the pier.

I can see no objection to the mill company using and occupying this part of the work.

The crib extension of this pier, however, extending beyond the shore-line, is being constantly injured by the pounding of barges, which are moored alongside while being made up into tows.

A large part of the south pier is used by the Menomonee River Lumber Company for the storage of lumber.

At the date of writing this report a length of 1,800 feet of the inner end of the south pier is almost entirely appropriated by this company.

The lumber is piled from 12 to 16 feet high, leaving for a part of the distance a clear space of about 2 feet in width on the channel side of the pier, and projecting beyond the south side for a distance of from 6 to 12 feet over the water.

This storage of lumber is not occasional but constant, the company using the pier in the same manner as if it were their own lumber yard, greatly to the inconvenience of the contractor for pier extension, as it is impassable for workmen and material.

In my annual report upon Menomonee Harbor for the fiscal year ending June 30, 1884, this subject is referred to as follows:

> The south pier of this harbor is extensively used by the Menomonee River Lumber Company for the storage of lumber, about 1,400 linear feet of the pier being now devoted to that purpose.
>
> In July, 1876, the United States was "asked to surrender 448 linear feet of this pier on condition that the company should keep the same in repair." The application was refused, and therefore no obligation now rests upon the company to repair the damage which the pier is constantly subjected to by such usage, and for which it was unintended.
>
> Injury is caused by the great weight upon the pier, but more especially is it damaged by severe poundings received from scows moored alongside to take in or discharge cargo.
>
> The pier has been re-inforced by the company for a distance of 500 to 600 feet, with a backing of slabs 60 feet in width, which enlarges the area for storing lumber and affords a roadway of communication. It is the purpose of the company to continue this slab-backing further out.
>
> There is no question but this addition to the pier adds greatly to its strength and permanence; and as the area to the south will gradually be filled by mill waste, it might perhaps be proper to consider the shore-line as having advanced with the slab-backing.
>
> Under this construction of the position of the shore-line, the United States could discontinue further repair of that portion of the pier re-inforced as above, leaving this work to be performed by the parties using the pier for wharf purposes.
>
> This is practically the condition of the north pier for a length of 600 feet, behind which filling has been placed, the shore-line advanced, and buildings erected
>
> The unauthorized use of the south pier by the lumber company should, in my judgment, be discontinued, and such use of the unre-inforced portion should not be permitted.

The use of these piers by the lumber and tow-boat companies for mooring heavy barges is causing such serious injury to these structures that I have had placed upon the north pier notices prohibiting this practice, and have also called the attention of the several towing companies to the matter in a letter of which the following is a copy:

> GENTLEMEN: The piers at the entrance to Menomonee Harbor are being seriously injured by mooring to them heavy vessels, especially lumber scows.
>
> It is manifest that this practice, if continued, will materially shorten the life of the superstructure and greatly increase the cost of maintaining the harbor. I have, therefore, directed cautionary notices to be placed on the north pier, warning vessels from making fast to that pier. This warning is not intended to apply to vessels in distress, or to prohibit small craft from occasionally touching at the piers, its special object being to prevent the improper, unnecessary, and injurious use of the piers for purely private purposes. I take this method of calling your special attention to this question in the belief that you will aid me in protecting the general interests of the harbor and of navigation by causing all vessels under your control to comply with the notices above referred to.
>
> Very respectfully, your obedient servant,
>
> J. W. BARLOW,
> *Lieut. Col. of Engineers.*

The result of these measures is not yet apparent.

In my judgment the use of the harbor piers outside the shore-line for any private purpose, except in case of distress, should be prohibited by a penalty enactment.

GREEN BAY HARBOR, WISCONSIN.

The timber revetment of the cut through Grassy Island, which forms a part of the improved channel to Green Bay, is frequently menaced with destruction by fire from the sparks of passing vessels. The superstructure of this revetment is old and must soon be reconstructed; it may then be modified so as to lessen its liability to injury from the above cause.

AHNEPEE HARBOR, WISCONSIN.

The south pier at this harbor is used as a wharf by the steam-boat which stops here six times a week. Nearly all the freight handled at the place passes over this pier. A warehouse, a fish market, and other buildings, as shown on the accompanying map of the harbor, have been built just back of this pier. The owner of these buildings, who is also the proprietor of the land on both sides of the harbor as far up as the Second Street Bridge, collects wharfage upon all freights which pass over the pier, this wharfage being equal, in some cases, to the freight from Manitowoc to Ahnepee. He has even presented bills for wharfage on Government supplies.

This person has, in fact, an entire monopoly of the business of the harbor, and must continue to have until the channel is carried up the river beyond the limits of his property.

This pier is being seriously damaged by the demands made upon it as a landing pier and freight wharf; and such use of it should be discontinued as soon as suitable wharfage can be provided higher up. * * *

MANITOWOC HARBOR, WISCONSIN.

The five inner cribs, comprising a length of about 180 feet of the north pier at this harbor, are used by the Goodrich Line of lake steamers as a permanent wharf. These cribs are, however, entirely within the shore-line, and as their occupancy by the steam-boat company involves the preservation of the work so occupied, I can see no objection to this part of the pier being entirely abandoned by the Government.

SHEBOYGAN HARBOR, WISCONSIN.

About 2,000 linear feet of the harbor piers were originally built by the city and county of Sheboygan. The United States has extended them, and rebuilt the superstructure over about 1,000 linear feet of the part built by the local authorities.

Of the portion of the piers repaired by the United States, about 220 linear feet of the north pier is used by fishermen in removing fish from their small boats to fish houses, but without damage to the pier.

These fish-houses are situated on the beach that has been formed by natural accretion since the piers have been built, and rent is paid for their use to Judge David Taylor, the ostensible owner of the land. It is understood that his title is based on a cession of the portion of the pier inside of the shore-line by the United States, on condition that it should be kept in good repair without expense to the United States.

About 200 linear feet of the south pier was occupied for many years by the Sheboygan and Fond du Lac, now Chicago and Northwestern, Railroad Company.

It is understood that the railroad company holds a perpetual lease from the city of Sheboygan for this portion of the pier upon the condition of keeping it in repair. It is now in a dilapidated condition and apparently abandoned by the railroad company. It should be placed in good repair by the local authorities or the railroad company. The United States has not rebuilt the superstructure over this part of the pier or, so far as known, made repairs to the same. * * *

REPORT OF CAPTAIN W. L. MARSHALL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., December 13, 1884.

SIR: In accordance with the requirements of General Orders, No. 13, Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, and of section 2 * * * of the river and harbor act of July 5, 1884, I have the honor to make the following detailed report for the works in my charge:

HARBORS OF RACINE, KENOSHA, AND MILWAUKEE, AND HARBOR OF REFUGE AT MILWAUKEE BAY, WISCONSIN, AND HARBOR OF WAUKEGAN, ILLINOIS.

None of the piers, breakwaters, or other structures built or made by the United States for the improvement of these harbors are used, occupied, or injured by any corporation or individual.

FOX AND WISCONSIN RIVERS, WISCONSIN.

Wisconsin River.— * * * No use, injury, or occupancy of the works constructed on this river is made or maintained by individuals or corporations.

Fox River, from Portage to Green Bay, including the Portage Canal.— The works for the improvement of the Fox River create and maintain valuable water-powers at various points where dams have been built by the Government, which powers are used by companies and individuals.

These water-powers were originally developed under charters to individuals and corporations granted by the legislature of the State of Wisconsin, and when the various works for maintaining the slackwater navigation of the Fox River passed by purchase from the Green Bay and Mississippi Canal Company into the hands of the United States in 1872, the water-powers created by them were not purchased by the Government, but remained in the possession and use of the owners thereof at the time of the purchase. Since the purchase by the United States many of the works have been rebuilt, but no new water-powers have been created, nor any power then existing increased by raising the height of the dams or otherwise. The right to use the water-powers maintained by the works is subject to the requirements of navigation, *i. e.*, only the surplus water not needed for navigation can be taken, and up to the present time no injury to the works or to the navigation of the river has resulted from such use of the surplus water. There is an inclination, however, on the part of the owners of powers to sell more water privileges than justified by the discharge of the river, and when the limit of low-water discharge of the river is nearly attained by the water-powers and lockages, it will be necessary to make stringent regulations defining the rights of navigation and of the water-power companies, and controlling the use of the water. At present there is no need of such regulations, as the surplus is still considerable, except at Menasha.

The water is taken from the river and canals by the parties entitled to its use at their own expense, and the flumes where they cut through the Government works must be, in accordance with plans approved by the United States officer in charge of the works, constructed so as not to injure or endanger the work.

The extent of such use of water-powers maintained by the Government is as follows:

On the Upper Fox there is one flour mill at Montello, 25 horse-power, the power being created by the dam now owned by the Government.

This mill is owned by Mary L. Lewis, and the power is leased from the Green Bay and Mississippi Canal Company.

On the Lower Fox, from Lake Winnebago to Green Bay, there is a large number of mills, a portion of which derive their water-powers from the public works as follows:

AT MENASHA.

	Horse-power.
A. Syme:	
Coral mill	501
Eagle mill	179
P. V. Lawson, flour mill	130
Menasha Paper and Pulp Company	222
Menasha Chair Company	100
Menasha Manufacturing Company, sash and doors	100
Davis & McKennon, Excelsior	90
C. R. Smith, broom-handles, etc	65
Menasha Wooden Ware Company:	
Saw-mill	208
Pail factory	75
John Strange, saw-mill	174
W. P. Hewitt & Co., woolen mill	49
James Little & Sons, foundry, etc	23
Webster Manufacturing Company, hubs and spokes	10
Gilbert & Whiting, paper mill	230
Total at Menasha	1,805

The water-power is maintained by the dam and canal at Menasha, and was conveyed by the Fox and Wisconsin Improvement Company, a corporation created by the State of Wisconsin, to Charles Doty and Harrison and Curtis Reed by a contract dated July 24, 1855.

> It being the intent and meaning hereof to include all hydraulic rights on the dam and canal, above the lock, for all purposes, not to obstruct its navigation or impair said canal.

The water-powers at Menasha are owned or leased by the successors of the said Doty and Reeds.

AT APPLETON, LEFT BANK OF RIVER.

	Horse-power.
Appleton paper and pulp mill	300
Atlas paper mill	400
Appleton Edison Light Company	35
Tirga paper mill	300
Vulcan paper mill	250
Water Works Company	50
Appleton Manufacturing Company	40
Total	1,375

This water-power was originally created by a wing dam built under the laws of Wisconsin, by the riparian owner, Mr. Theodore Conkey. Afterwards, in 1852, when the State of Wisconsin built the upper dam at Appleton across the river, for the purpose of navigation, it was connected with this wing-dam. The present owners derive their title from Mr. Conkey. The power is now maintained by the Government dam.

APPLETON, RIGHT BANK.

	Horse-power.
Atlas Paper Company	700
Atlas Paper Company	750
Appleton Boot and Shoe Company	10
L. A. Pfeifer & Co., tannery	20
Miller & Johnson, hubs and spokes	25
Walters & Bauer Toy Works	25
Total	1,530

This power is maintained by the upper (Government) Appleton dam and the canal on the right side, and is leased or purchased from the Green Bay and Mississippi Canal Company.

AT APPLETON, LOWER DAM.

	Horse-power.
Richmond Brothers, paper-mill	150
John Rose, saw-mill	100
Baum & Hume, flour	35
John Angus, cheese boxes	25
Total	310

This power is maintained by the lower Government dam, and is leased from the Green Bay and Mississippi Canal Company.

AT LITTLE CHUTE.

	Horse-power.
John Verstegen, flour mill	50

This power is maintained by the dam at Little Chute, and is leased from the Green Bay and Mississippi Canal Company.

AT KAUKAUNA.

	Horse-power.
Reuter Brothers, hubs and spokes	50
Doane & Hoberg, pulp mill	50
John Jansen, sash and doors	50
Franklin Mills Company, flour	60
H. A. Frambach, paper mill	200
Total	410

This water-power is created and maintained by the dam at Kaukauna and is leased from the Green Bay and Mississippi Canal Company.

In addition to the above, Bradner, Smith & Co., pulp mill, 475 horse-power, obtains its power partly from that created by the Kaukauna Dam, but mainly from the works of the Kaukauna Water Power Company, which is the successor to the Fox River Hydraulic Manufacturing Company, chartered under the general laws of Wisconsin, April 26, 1872.

AT LITTLE KAUKAUNA.

	Horse-power.
S. S. Clark, saw-mill	25

This water-power is created by the dam at Little Kaukauna, and is leased from the Green Bay and Mississippi Canal Company.

AT DE PERE.

	Horse-power.
Arndt Brothers & Dousman	100
Dunham & Davis	100
Novelty Manufacturing Company	60
M. Reynan	60
C. R. Merrill	80
Fox River Iron Company	100
J. S. Monroe	40
Gow & Co	25
Total	565

This power is maintained by the dam at De Pere and by private parties. It is held under a grant from the legislature of the State of Wisconsin, approved February 9, 1850, to Joshua F. Cox and his heirs and assigns forever, upon certain conditions as to the construction and maintenance of the lock, dam, and canal at the rapids at De Pere. The individual powers were purchased or leased from Cox and his successors.

As already stated, the Government has suffered no injury, and, as yet, has been at no expense on account of these water-powers. They are held subject to the requirements of navigation, but in the near future laws or regulations exactly defining the rights and obligations of the water-power companies and of the public, and the mode, extent, and circumstances of the use of the water-powers for industrial purposes must be made. The owners, under the State charters, of the water-powers, are inclined to sell all possible water privileges, and at Menasha they have attained nearly the low-water discharge of that outlet, but still advertise powers for sale or lease. Further sale of water privileges at Menasha, at least of powers taking water from the Menasha Canal, should be prohibited as detrimental to navigation.

* * * * * * *

Very respectfully, your obedient servant,

W. L. MARSHALL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR W. H. H. BENYAURD, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Chicago, Ill., December 19, 1884.

GENERAL: In accordance with instructions contained in General Order No. 13, from Headquarters Corps of Engineers, Washington, D. C., July 23, 1884, I have the honor to present the following report upon the occupation of the piers and breakwaters at Chicago Harbor, by individuals and corporations, as called for by section 2, * * * of the river and harbor act approved July 5, 1884.

I transmit herewith two charts: No. 1, giving the outlines of the present harbor, and No. 2, showing the extent of pier-work constructed by the United States, that is at present occupied by individuals and corporations, and the names of the occupants.

The work of improvement at this harbor was commenced in 1833, by making a cut through the bar at the mouth of the river, so as to give a straight outlet into the lake, and by constructing a pier on the north bank. This latter work began at a point coinciding with what is now the center line of Pine street, and was in length about 1,000 feet. A pier was also constructed on the south side of the river parallel to that on the north side, a portion of which, however, was afterwards removed and replaced by a crib construction further back. These two lines of piers were continued eastward into the lake from time to time as appropriations were made therefor. At some period the Illinois Central Railroad was allowed to cut through the south pier and construct Slips A, B, and C, as shown on the map.

EXTENT OF CRIB-WORK OCCUPIED.

The crib-work on the north side of the river is entirely occupied by corporations and individuals except the easterly 170 feet, which was built by the United States in 1859 for the foundation of the light-house. Commencing at the westerly end, the following is a list of occupants and the length of frontage occupied:

Occupants.	Occupation.	Extent.	Owners of adjacent land.
		Feet.	
Kirk & Co	Soap manufacturers	332	Kirk.
Brazil and Chicago Coal Company	Coal	329 125	McCormick estate. Producers Marble Company.
Peshtigo Lumber Company	Lumber	538	The land occupied by these firms is leased from the Chicago Canal and Dock Company.
C. J. L. Meyer	do	400	
John I. Culliton	Coal	152	
David Wylie	do	152	
Rathbone, Said & Co	Stove warehouse	58	
Fuller, Warren & Co	do	77	
Fitz Simmons & Connell	Lumber	380	

On the south side the United States crib-work, on the westerly end for a distance of 270 feet, has been partially replaced by a substantial stone dock with fender-piling, built by the city of Chicago; thence easterly to Slip A the United States work has been re-inforced by piling backed with sheeting.

The following is a list of occupants and the length of frontage occupied:

Occupants.	Occupation.	Extent.	Owners of adjacent land.
		Feet.	
Goodrich Steam-boat Company		500	Owned by city of Chicago and Michigan Central Railroad.
Illinois Central Railroad	Railroad	219.5	
Do	do	121	
Do	do	148	
Lumber yards		257	Leased to occupants by the Illinois Central Railroad.

CONDITION.

With the exception of the frontage of 170 feet occupied by the light-house establishment, the whole extent of crib-work occupied, as before-mentioned, on the north side is in a more or less dilapidated condition. There seems to have been but little, if any, work of repair done in a number of years, especially along the part occupied by the Peshtigo Lumber Company. At the commencement or westerly limit of the Government work the frontage now occupied by Kirk & Co. has been partially repaired by the construction of a new and substantial line of dockage, commencing at a point 90 feet west of the center line of Pine street, and extending easterly 422 feet. The remaining frontage of crib-work, 2,211 feet, is greatly in need of repair. On south side of river, from beginning of Government work to Slip A of the Illinois Central Railroad, the crib-work has been replaced by structures of a substantial character. As before stated, all is in a fair condition except the east 100 feet and corner of the slip. The 121 feet between Slips A and B, the portion 148 feet between B and C, and the 257 feet east of Slip C, which is occupied as a lumber-yard by Messrs. Luddington, Wells and Van Schaick, are all in a bad condition and in need of repair. I estimate to carry on the work needed on the north and south sides will cost about $40,000.

Very respectfully, your obedient servant,

W. H. H. BENYAURD,
Major of Engineers.

Brig. Gen. JOHN NEWTON,
Chief of Engineers, U. S. A.

REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., December 15, 1884.

SIR: I have the honor to submit the following report, in accordance with the provisions of section 2 of the river and harbor act of July 5, 1884.

The only locality in the district committed to my charge where "piers, breakwaters, and other structures or works built or made by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or any individual," etc., is Saginaw River, Michigan, and the appended report by Mr. B. H. Muehle, assistant engineer, shows the extent of such use, occupation, or injury.

* * * * * * *

Very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Genl., U. S. A

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. B. H. MUEHLE, ASSISTANT ENGINEER.

UNITES STATES ENGINEER OFFICE,
Detroit, Mich., December 10, 1884.

GENERAL: In compliance with your instructions, dated October 21, 1884, to report "in regard to existing or proposed obstructions or improper use of the works of the United States in or pertaining to Saginaw River," etc., I now have the honor to make the following report:

The only structures or works built by the United States in aid of commerce and navigation on Saginaw River are: (*a*) The United States revetment and extensions upon the easterly side of the channel, opposite the Carrollton Bar, 4,828 feet long; (*b*) a plant beam wall upon the west side of said channel, 200 feet distant from the said revetment, length 3,500 feet; and (*c*) a pile and edging pier or wing-dam at the head of Crow Island, 900 feet long. The works at Carrollton have been frequently injured and partially destroyed by fire, caused by sparks from passing tugs or steamboats, which use pine slabs for fuel and are not provided with spark-catching devices upon their smoke-stacks. The pier at Crow Island is often used by the boom company and private parties for hanging rafts of logs alongside for temporary storage, whenever the adjacent store or mill booms are full. An actual damage to the pier itself, by reason of this use and occupation, is not apparent, but it can not be overlooked that the navigable channel opposite the pier during such occupancy is partially obstructed to the extent of the width of the rafts lying alongside.

* * * * * * *

Very respectfully, your obedient servant,

B. H. MUEHLE,
Assistant Engineer.

General O. M. POE,
Lieutenant-Colonel of Engineers, U. S. A.

REPORT OF MAJOR L. COOPER OVERMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cleveland, Ohio, January 20, 1885.

GENERAL: In compliance with General Orders, No. 13, Headquarters, Corps of Engineers, United States Army, Washington, D. C., July 23, 1884, I have the honor to submit the following *final* report:

MONROE HARBOR, MICHIGAN.

The bank of the United States canal at this harbor is occupied by the "Monroe Fishing Club" houses. There are two or more buildings belonging to this club. There are also two fish-houses and two ice-houses belonging to individuals on the bank of the United States canal. The occupation and use of said bank of canal is without permission, so far as records of this office show, but no especial injury to United States property is occasioned by the occupancy. Would respectfully suggest that all parties trespassing would be compelled to obtain written permission to so occupy the United States canal bank, and be subject to the orders of the "engineer in charge" of the harbor.

TOLEDO HARBOR, OHIO.

The United States has not built any "piers, breakwaters, or other structures," in aid of commerce or navigation for this harbor, hence there can not be occupancy or use of same by individuals or corporations.

SANDUSKY CITY HARBOR, OHIO.

Similar case as that at Toledo Harbor.

PORT CLINTON HARBOR, OHIO.

The piers, etc., built at this harbor by the United States are not used or occupied by any corporation or individual.

Considerable trouble has been occasioned at times by parties removing sand (for sale) from off the narrow sand-beach which separates the river from the lake at the inner end of west pier. The parties removing the sand had permission from the owners of the beach.

It is respectfully suggested that some action of Congress should be had to protect the junction of piers, etc., with the shore, or defining the right of the United States to control said beaches, which in most instances are the result of structures built by the United States for the improvement of the harbor.

HURON HARBOR, OHIO.

The piers built at this harbor by the United States are not used or occupied by any corporation or individual.

Remarks similar to those for Port Clinton Harbor, as to sand-beaches, etc., apply equally to this harbor.

VERMILLION HARBOR, OHIO.

The piers at this harbor are not occupied by any individual or corporation.

BLACK RIVER HARBOR, OHIO.

The piers at this harbor are not occupied or used by any individual or corporation.

ROCKY RIVER HARBOR, OHIO.

The pier at this harbor is not occupied or used by any individual or corporation.

CLEVELAND HARBOR, OHIO.

Piers and breakwater *are* occupied and used both by individuals and corporations.

East pier.—Occupied in part by the tracks of the Cleveland and Pittsburgh Railway Company, by special act of Congress, approved August 14, 1876, by which act the railroad company were to have use of and occupy part of said east pier, provided the railroad company should keep the pier in good condition.

It is respectfully suggested that the pier is not kept in good condition by the Cleveland and Pittsburgh Railway Company.

West Pier.—Occupied and used by club-house of the Gardner Canoe Club, of Cleveland, Ohio. Permission given by the honorable Secretary of War.

Occupied and used by Mr. Samuel Law, of Cleveland, Ohio, with boat-houses, where pleasure boats for fishing and rowing, etc., are kept for hire. Has so occupied and used part of said west pier for a number of years (over six years)—no record of any permission so to do. A sort of "squatter privilege," or by sufferance at first, which possession has strengthened. The keeper of the life-saving station, which is located on the west pier, has constructed a dwelling-house and boat-house, where boats may be rented for pleasure. Permission given to erect said extra building by Col. John M. Wilson, Corps of Engineers (the then officer in charge), in October, 1882.

Fishing boats land at or near the said boat-houses, and give much annoyance at times with unloading and dressing of fish.

Whilst these boat-houses, etc., which occupy and use the said west pier do not materially injure said pier, their occupancy is a precedent for other parties who desire to get a foot-hold, and the trespassers already there make every effort to increase their privileges (?).

I would respectfully suggest that *all* parties now occupying this pier be given to understand that they are *trespassing*—be compelled to obtain permission to occupy and use said pier and to be subject in all respects to the orders of the "engineer in charge" of the harbor.

Breakwater "shore-arm."—On beach near inner end of shore-arm a boat-house for hire of pleasure boats and sale of refreshments was erected in the spring of 1884. Parties claim to have rented privilege of the owner of the land, but one of the houses is certainly on pile of rip rap stone placed by the United States for protection of the junction of breakwater and shore. Their occupancy and use do not materially injure the breakwater, but it is an encroachment upon United States property which may become hereafter very objectionable. They should be placed subject to the orders of the "engineer in charge." The lake-arm of the breakwater is not used or occupied in any way. It perhaps will be attempted by vessel-men when the harbor of refuge is completed.

FAIRPORT HARBOR, OHIO.

The piers at this harbor, as now recognized as United States piers and which are kept in repair by the United States, are not occupied by any individuals or corporation.

In conclusion, I would respectfully suggest that it would be advisable if Congress should take some action, in a general act, giving the engineer in charge of any United States improvement some definite and fixed power to regulate the improper use of piers, breakwaters, etc.

Very respectfully, your obedient servant,

L. COOPER OVERMAN,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN EDWARD MAGUIRE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Buffalo, N. Y., August 8, 1884.

GENERAL: In compliance with General Orders, No. 13, headquarters Corps of Engineers, U. S. Army, July 23, 1884, I have the honor to submit the following report:

In 1798, certain Dutch capitalists (commonly known as the Holland Land Company) purchased from the Seneca Indians parts of their reservation at the mouth of Buffalo Creek.

In 1819 the legislature of the State of New York passed an act to lend $12,000 for the purpose of building a harbor at Buffalo. In 1820 the construction of piers was commenced, and during 1821 the proposed harbor was completed. Colonel Cram in his report of June 20, 1867, to the Chief of Engineers, says:

> It consisted of * * * north pier, composed of a double row of piles filled with brush and sand.

By the act of May 26, 1826, Congress appropriated the sum of $15,000 for "building a pier and repairing an old one at the mouth of Buffalo Creek." In his report of June 20, 1867, Colonel Cram says:

> Upon that [the appropriation of $15,000 by Congress, 1826], the United States Engineers took possession and made it a governmental work.

The north pier, as built in 1821, was constructed *in the water* outside of low-water mark. The soil on which the pier rested was the property of the State of New York, and the title of the Holland Land Company extended only to the low-water mark.

On December 1, 1827, the Holland Land Company conveyed by *warranty deed* to Walter M. Seymour a certain tract of land adjoining the north pier, but in the language of the deed the conveyance was "*to the pier* on the margin of Buffalo Creek; thence by *said pier*," etc.

On December 5, 1827, Walter M. Seymour conveyed the same tract to John C. Lord, by *warranty deed*, but in the language of the deed the conveyance was "*to the pier and thence by said pier*," etc.

On December 10, 1827, however, the Holland Land Company conveyed to John C. Lord, by a *quitclaim* deed, "all the land covered and occupied by the United States pier, lately erected on the north side of Buffalo Creek and harbor, in the village of Buffalo," etc.

On March 21, 1829, John C. Lord conveyed to Joseph Dart, jr., land covered by the United States pier.

On August 13, 1836, John C. Lord and others conveyed to Thomas R. Stocking land on which the United States pier rested.

On April 4, 1837, Thomas R. Stocking reconveyed to John C. Lord and Ira Joy the land deeded to him by Lord and others.

On February 24, 1868, John C. Lord and others conveyed to the Delaware, Lackawanna and Western Railroad Company the land on which the United States north pier rests. The claim of the Delaware, Lackawanna and Western Railroad Company, therefore, to the land on which the pier rests is based on the quitclaim deed of the Holland Land Company to John C. Lord, December 10, 1827. The United States held undisputed possession of the north pier from 1826 to 1878, or over fifty years.

In his annual report for the fiscal year ending June 30, 1879, Maj. Walter McFarland, then in charge of Buffalo Harbor, says:

> In the early part of last year I was informed by Mr. Mayo, the inspector of harbor work at Buffalo, that the Delaware, Lackawanna and Western Company were encroaching upon the north United States pier at Buffalo, and filling in behind it in such a way as to render useless the Government structures there, viz, the boat-house belonging to the light-house service, the life-saving station, and the engineer boat-house, on the ground that the United States possessed no title to the site, and that title was their own through purchase.
>
> This matter was reported to the Chief of Engineers on the 17th of August, 1878, and on the 3d of September I was informed that the Acting Attorney-General of the United States had "instructed the United States district attorney for the northern district of New York to take such action in the matter as he may deem necessary."
>
> No action, however, appearing to have been taken, and the encroachment continuing and increasing, on the 29th of March, 1879, under instructions from the Chief of Engineers, I wrote to the United States district attorney for the northern district of New York, informing him of the condition of affairs, and, in answer, was informed by the newly appointed district attorney that the correspondence with his predecessor regarding the matter was before him, and that it would receive his attention as soon as possible.
>
> Under date of May 20, he wrote me to the effect that he was making every effort to investigate the title, but with little success so far; and, in response, I gave him all the information that I had about it, which amounted to this, that the United States had been in undisputed possession of this site for over fifty years, ever since 1826, when the first appropriation for this harbor was made, and had built on, extended, and repaired this pier ever since, as the interests of the harbor and of the Government seemed to require.
>
> This is the last of the correspondence on the subject.
>
> In the meanwhile the Delaware, Lackawanna and Western Company have gone on filling in behind the pier; have rendered useless the boat-house belonging to the light-house service and the life-saving station, which, at great expense, are to be moved across the creek to the light-house reservation, and threaten to drive us out of our engineer boat-house at the end of the pier, which we can now reach only by passing through a fence which they have erected to shut off the pier and the space behind it from the public street.
>
> The pier itself is in daily use as a wharf for the shipment of coal which they have stored on the filled ground behind it, while the contractor for the breakwater extension has been forbidden to use it for the storing and framing of timber, as has always been allowed by the United States ever since the work first began.

The further history of the occupation of the pier by the railroad company is fully set forth in Major McFarland's annual report for the fiscal year ending June 30, 1880, and published in the Report of the Chief of Engineers, U. S. Army, 1880, Part III, pages. 2195–2201.

It would appear that:

(1) The soil on which the north pier rests was at the time of its construction the property of the State of New York.

(2) That the State of New York, in 1819, dedicated that soil to the public use by authorizing the construction of the pier.

(3) The United States assumed control of the pier, and hence of the soil under it, in 1826.

(4) The Holland Land Company never owned the soil under the pier, but owned only to low-water mark, and hence could not convey that soil. It would appear that the land company did not itself claim that soil, for it departed from its rule of giving warranty deeds and gave only a quitclaim deed to John C. Lord.

(5) As the claim of the Delaware, Lackawanna and Western Railroad Company to this soil is based on the quitclaim deed by the Holland Land

Company to John C. Lord, it has no title to the soil for the reason that if the thing granted was not in the grantor no right passes to the grantee.

That the title to the soil was in the State of New York, I would respectfully refer to the following decisions: County of Saint Clair *v.* Livingston (23 Wallace, 26); Martin *v.* Waddell (16 Peters, 367); Russell *v.* The Jersey Company (15 Howard, 426); Barney *v.* Keokuk (4 Otto, 324). For the status of land dedicated to public use, I would refer to, Mayor of New Orleans *v.* The United States (10 Peters, 662).

Very respectfully, your obedient servant,

EDW. MAGUIRE,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

SUPPLEMENTARY REPORT

UNITED STATES ENGINEER OFFICE,
Buffalo, N. Y., October 18, 1884.

GENERAL: Referring to my report of August 8, 1884, in compliance with General Orders, No. 13, Corps of Engineers, July 23, 1884, I have to state that I have since obtained information which I did not know of at the time of making the report.

The information received will be found embodied in the memoranda herewith forwarded. It will be seen that the result reported by me previously that the Delaware, Lackawanna and Western Railroad Company had not and never did have any title to the soil on which rests the United States north pier, is unchanged. But my conclusion that the State of New York owned the soil was erroneous, as it will be seen that the State of Massachusetts owned it and sold it to Robert Morris, who never conveyed it.

The attorney of the railroad company, who has had several interviews with me on the subject, at our last meeting on the 13th instant acknowledged the title was not in the company.

Very respectfully, your obedient servant,

EDW. MAGUIRE,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

MEMORANDA.

(1) The colonies of Massachusetts and New York both had charters under which they each laid claim to all western and central New York. About the close of the Revolution, they both ceded to the United States all claim to the territory west of a line drawn south from the western extremity of Lake Ontario. In order to adjust their conflicting claims, New York and Massachusetts each appointed commissioners to decide upon and draw up an agreement. These commissioners met in Hartford, Conn., on November 30, 1786, and on December 16, 1786, made an agreement by which Massachusetts yielded all claim to the land east of the present east line of Ontario and Steuben counties; west of that line New York should have the government, sovereignty, and jurisdiction of the land, while Massachusetts should have the title in fee-simple to the land subject to the Indian occupancy. That is to say, the Indians could hold the land as long as they pleased, but were allowed to sell

only to the State of Massachusetts or her assigns. The agreement reads as follows:

> First. The Commonwealth of Massachusetts doth hereby cede, grant, release, and confirm to the State of New York forever, all the claim, right, and title which the Commonwealth of Massachusetts hath to the government, sovereignty, and jurisdiction of the lands and territories so claimed by the State of New York as hereinto before stated and particularly specified.
>
> Secondly. The State of New York doth hereby cede, grant, release, and confirm to the said Commonwealth of Massachusetts, and to the use of the Commonwealth, their grantees, and heirs and assignees of such grantees forever, the right of pre-emption of the soil from the native Indians; and all other the estate, right, title, and property (the right and title of government, sovereignty, and jurisdiction excepted) which the State of New York hath of, in, or to 230,400 acres to be located by the Commonwealth of Massachusetts, and to be situated to the northward of and adjoining to the lands granted respectively to Daniel Cox and Robert Lettice Hooper and their respective associates and between the rivers Onego and Chenango; and also of, in, or to all the lands and territories within the following limits and bounds, that is to say: Beginning in the north boundary line of the State of Pennsylvania, in the parallel of 42° of north latitude, at a point distant 82 miles west from the northeast corner of the State of Pennsylvania on the Delaware River, as the said boundary line hath been run and marked by the commissioners appointed by the States of Pennsylvania and New York respectively, and from the said point or place of beginning running on a due meridian north to the boundary line between the United States of America and the King of Great Britain, thence westerly and southerly along the said boundary line to a meridian which will pass 1 mile due east from the northern termination of the strait or waters between Lake Ontario and Lake Erie, thence south along the said meridian to the south shore of Lake Ontario, thence on the eastern side of the said strait by a line always 1 mile distant from and parallel to the said strait to Lake Erie; thence due west to the boundary line between the United States and the King of Great Britain; thence along the said boundary line until it meets with the line of cession from the State of New York to the United States; thence along the said line of cession to the northwest corner of the State of Pennsylvania, and thence east along the northern boundary line of the State of Pennsylvania to the said place of beginning.

By this agreement Massachusetts obtained the title to the soil under the water at what is now known as Buffalo Harbor.

(2) In 1788 Massachusetts sold all her land in New York to Phelps & Gorham for $1,000,000, to be paid in certain Massachusetts stocks, then worth about 20 cents on the dollar. These stocks subsequently rose in value, and Phelps & Gorham were unable to make the payment; the State of Massachusetts therefore released them from all except that land the Indian title to which they had extinguished, and on March 8, 1791, sold to Robert Morris the pre-emption right and all other rights, title, and interest which the Commonwealth of Massachusetts had in and to certain lands, one tract of which was described in the deed as follows:

> Beginning at a point on the north line of the State of Pennsylvania 60 miles west of the southwest corner of the land confirmed to Nathaniel Gorham and Oliver Phelps from said point running west until it meets the land ceded by the Commonwealth of Massachusetts to the United States of America and by said United States sold to the State of Pennsylvania; thence northerly by the land ceded as aforesaid to Lake Erie; from thence northeasterly by Lake Erie to a tract of land lying on the easterly side of the strait of Niagara, belonging to the State of New York; thence northerly by said tract to a line in Lake Ontario which divides the dominions of the King of Great Britain and the said United States; thence easterly on said dividing line to a point from whence a meridian line will fall on the point of beginning, *together with the right of pre-emption which the Commonwealth hath to all islands or waters in Lake Erie by virtue of any cession from the State of New York to said Commonwealth*, reserving out of the same granted premises one undivided sixtieth part thereof.

This sale was made by virtue of the tenth article of the agreement of 1786 between the States of New York and Massachusetts, which article reads as follows:

> Tenthly. The Commonwealth of Massachusetts may grant the right of pre-emption of the whole or any part of the said lands and territories to any person or persons who, by virtue of such grant, shall have good right to extinguish by purchase the claims of the native Indians.

By that deed Robert Morris became possessed of the soil under the water at what is now known as Buffalo Harbor.

(3) On December 24, 1792, Robert Morris sold to Herman Le Roy and John L. Lincklaen land described as follows:

> Beginning at a point on the southern shore of Lake Ontario 1 mile due east from the northern termination of the strait which divides Lake Ontario from Lake Erie, being a corner of lands reserved by the State of New York, and from said point extending along the shore of Lake Ontario eastwardly so far as upon actual mensuration shall be found necessary to include within the lines and bounds hereinafter mentioned and described the full and just quantity of 1,000,000 acres of land exclusive of lands covered with the waters of ponds or lakes within the same, which shall be more than 4 miles in circumference, as to such pond or lake, and from the termination of the said boundary so to be ascertained, extending by a meridian line due south to the boundary of the State of Pennsylvania, thence by the same west to a corner of a triangular piece of land granted by the United States to the State of Pennsylvania; thence by the perpendicular line of said triangle due north to *the shore of Lake Erie; thence along the shore of Lake Erie* to the place where the lines of lands reserved by the State of New York shall be found to intersect the said shore; thence along the lines and bounds of the said reserved lands, northwardly and eastwardly, to the point of beginning.

It is to be seen that Morris did not sell the soil under the waters of Lake Erie.

(4) On May 30, 1795, Herman Le Roy and John Lincklaen sold the same tract to William Bayard, the deed retaining the description "to the shore of Lake Erie," etc.

(5) In June, 1795, William Bayard sold the same tract with same description to Herman Le Roy, John Lincklaen, and Gerrit Boon.

(6) Herman Le Roy, John Lincklaen, and Gerrit Boon sold the same tract with the same description to Paul Busti, on July 9, 1798.

(7) On July 10, 1798, a tripartite deed was executed, by which the Holland Land Company became possessed of the same tract with the same description "to the shore of Lake Erie," etc. The parties to the deed were Paul Busti, of the first part, Herman Le Roy, William Bayard, James McEvers, John Lincklaen, and Gerrit Boon, of the second part, and the Holland Land Company of the third part.

(8) In 1797 Robert Morris, who had in 1792 sold the tract to Herman Le Roy and John Lincklaen, subject to the settlers extinguishing the Indian title, closed the sale at a treaty made with the Seneca Indians at Genesee, by which he bought out the Indians' title to all the Seneca lands except eleven reservations of various sizes. Of these the Buffalo Creek Reservation was the largest, containing 130 square miles, and lying on both sides of Buffalo Creek.

(9) In making surveys in 1798, Joseph Ellicot, the Holland Land Company's surveyor and agent, found that the New York mill strip along the Niagara River and the Seneca Buffalo Creek Reservation shut out the Holland Company from a town-site at the foot of Lake Erie. One William Johnston, an Indian trader, had settled near the mouth of Buffalo Creek. He had procured from the Indians by a gift or purchase 2 square miles of land at the mouth of Buffalo Creek. He had also entered into an agreement with the Indians, which amounted to a life lease of a certain mill-site. This site was about 6 miles east of the mouth of the creek. Although Johnston's title to the land was not considered to have the least validity, yet the Indians had the power and inclination to include it within their reservation unless a compromise was made with Johnston, and, taking into consideration his influence with the Indians, the agents of the Holland Company concluded to enter into an agreement with Johnston by which he was to surrender his right to the 2 square miles of Buffalo Creek, and which lay on the north side of the

creek. Johnston persuaded the Indians to leave it out of their reservation, and the Holland Land Company pre-empted it. We now have the Holland Land Company in possession of land at the mouth of Buffalo Creek, but not of the soil under the waters, and the Holland Company never acquired by purchase or otherwise the said soil.

Under date of December 10, 1827, the Holland Company made a quitclaim deed, conveying to John C. Lord "all the land covered and occupied by the United States pier lately erected on the north side of Buffalo Creek and Harbor, in the village of Buffalo," etc.

On March 21, 1829, John C. Lord conveyed to Joseph Dart, jr., "one undivided fourth or quarter part of the land covered by the United States pier on the north side of Buffalo Creek," etc.

On August 13, 1836, John C. Lord and others conveyed to Thomas R. Stocking land on which the pier rests.

On April 4, 1837, Thomas R. Stocking reconveyed to John C. Lord and Ira Joy the land deeded to him on August 13, 1836.

On February 24, 1868, John C. Lord and others conveyed to the Delaware, Lackawanna and Western Railroad Company the land on which the pier rests.

The ground, therefore, on which the Delaware, Lackawanna and Western Railroad Company claims "that it is the owner in fee by regular proper title of the land on which the pier rests" is the original conveyance by the Holland Company to John C. Lord, and the subsequent conveyance up to February 24, 1868.

But the Holland Company did not have the title to the land, and hence the Delaware, Lackawanna and Western Railroad Company has no title to the land on which the pier rests.

EDW. MAGUIRE,
Captain of Engineers.

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Oswego, N. Y., September 20, 1884.

SIR: In compliance with General Orders, No. 13, Headquarters Corps of Engineers, current series, I have the honor to submit the following report in reference to piers or other aids to navigation built by the United States being used or injured by corporations or individuals within the district in my charge, and also as to whether any bridges or other structures erected or in process of construction in this district are an interference with navigation.

The only cases coming under this order that have come to my knowledge are the following:

OSWEGO, NEW YORK.

Old east breakwater.—The old east breakwater was built by the United States at the same time (1827–'29) as was the old west breakwater, and in prolongation of its line. Its present length is 597 feet, with a shore-line of 160 feet in addition.

At some date, about 1852, this east breakwater was transferred to Mr. Gerrit Smith, who then built the 900 feet river channel-pier and the wharves under the fort in the "East Cove." Since that date (1852 to

1855) the east breakwater has been kept in repair by Gerrit Smith, and is regarded as the property of his estate. No record of the transfer is on file. No injury to the interests of the United States or of the harbor has resulted from the transfer, but the United States has avoided the cost of repair, which has been large, as besides the ordinary decay the work has been twice or more breached, and about 100 linear feet carried away.

Outer harbor.—Encroachment upon by construction of a coal trestle. In 1882 the Oswego and Syracuse Railroad Company built a coal trestle in the outer harbor, extending to within about 400 feet of the outer breakwater and about 400 feet farther than the limit for the dock line established by the Board of Engineers who made the plan of the harbor upon which Congress has based the appropriations for this improvement. The Chief of Engineers had decided that he had no authority to extend the dock line, and the engineer officer in charge had notified the company that they could not build their trestle beyond the dock line established by the Board of Engineers, namely, the 12-foot curve. The case was turned over to the Department of Justice, and I understand is to be decided by the courts. The facts are stated in the letters of Lieut. Col. W. McFarland to the Chief of Engineers, dated May 17 and July 20, 1882.

CHARLOTTE, NEW YORK.

Piers within the shore-line. At this harbor about 2,000 linear feet of the shore end of the west pier, and a portion of the east pier, now lie within the shore-line, the beach having greatly advanced by accretions since 1829, when the work was begun.

A considerable portion of this is now occupied and maintained by the iron company, whose works front on the river at this point. No injury accrues to the United States by their occupancy.

A steam chain-ferry runs across the channel near the present beach-line (about 400 feet inside of it on the west side, 150 feet on the east side), and its landing on the east pier is effected by cutting down the old pier to water-level. No special injury results to the United States, and in fact it is assumed that the United States has abandoned the portion of the piers inside the shore-line.

OTHER HARBORS ON LAKE ONTARIO WITH ENTRANCES FORMED BY UNITED STATES PIERS.

At all harbors on Lake Ontario with the entrance formed by piers from the shore, just as at Charlotte, there have been accretions since the piers were commenced, so that the inner ends of the piers have practically become the dock fronts of private property, and I assume that they are abandoned by the United States. Their occupation by the owners of the adjacent land is no injury to commerce or the United States, provided the United States is at no expense in keeping them in repair. This would apply to the harbors of Wilson, Oak Orchard, Charlotte, Pultneyville, Great Sodus, and Little Sodus, New York.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF COLONEL C. SEAFORTH STEWART, CORPS OF ENGINEERS.

SAN FRANCISCO, CAL., *August* 4, 1884.

SIR: In response to General Orders No. 13, Headquarters Corps of Engineers, July 23, 1884, the following statement is made in regard to the levee at San Diego, built to aid commerce indirectly:

The top of this work is nearly level and from 16 to 23 feet wide. At all seasons it forms a dry, elevated, and excellent roadway across the low plain, and is therefore used as such by the community at large. This use does no injury to the work. The levee is not fenced in. During and after the wet season considerable herbage of various kinds grows on east side of the embankment. These lowlands have consequently been used from the early days as a common for the grazing of animals, which are left to rove at will. To pass from one side of the levee to the other they and men have formed trails across the embankment at a few convenient points. In following these crossings some injury has been done to the reverse slope of the embankment, and a little of the top of the stone revetment of its river slope has been loosened or knocked away. But the damage amounts to little. The efficiency of the work is not affected, though the annual cost of repairs is slightly increased.

The original project provided for a fence. But unless a watchman were kept to watch and protect it, the fence would be of little use. It would serve as a supply of fire-wood to tramps at all seasons, and to furnish posts and fencing boards to any needy or unscrupulous resident of Old Town whenever wished. The original cost and that of the repairs necessary yearly to make good the losses referred to and of those due to knocking away panels at convenient points for cattle-trails by the owners of the latter would be far greater in the end than that due to the slight repairs needed at present to make good the damage done by cattle.

Very respectfully, your obedient servant,

C. SEAFORTH STEWART,
Colonel of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL G. H. MENDELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE.
San Francisco, Cal., January 7, 1885.

GENERAL: The following report is respectfully submitted on the subjects referred to in General Order No. 13, Headquarters Corps of Engineers, July 23, 1884, and in the act of Congress of July 5, 1884:

* * * * * * *

No piers, breakwaters, or other structures or works built by the United States in aid of commerce or navigation, situated within the field of operations of this office, are known to be used, occupied, or injured by a corporation or by individuals, except in this, that the piers of Oakland Harbor are more or less injured in a petty way by fishermen, who have in several instances opened a passage to enable small boats to cross, and save to themselves a detour of several miles required to pass around the outer end of the piers. The extent of the damage done in a trespass of this kind amounts to a few dollars—perhaps twenty, perhaps fifty. The passage is made by removing enough stone from the tops of the jetties to enable the boats to pass at a high stage of the tide.

Some trifling injury is also, at times, done to the main line of the jetty at Wilmington by trespass of idlers or fishermen in landing on the graveled portions of the line and hauling up their boats, displacing the gravel deposited there for the security of the timber-work. This kind of injury scarcely admits of definition or description, and while it is an annoyance, it seems difficult to remedy.

Very respectfully, your obedient servant,

G. H. MENDELL,
Lieut. Col., Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CHARLES F. POWELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Portland, Oregon, December 12, 1884.

SIR: I have the honor to submit the following report of the use, occupation, or injury to certain United States works in aid of commerce.

* * * * * * *

JETTY AT MOUTH OF THE COQUILLE RIVER, OREGON.

This work, projected in 1881, was a half-tide structure. That it was faulty in being low, was a conviction with J. Parker, of Parkersburgh, Oregon, a leading citizen of the Coquille Valley, and with some others.

A general reduction in height of 1 foot from action of the seas had taken place by June, 1882, leaving the jetty about 1 foot above mean low water.

In that month Mr. Parker, with others, took possession of the jetty, when operations were suspended, and raised a part of it some 4 feet in height by placing on the top boxes filled with ballast. Some of these boxes were attached to the uprights of the cribs, of which the jetty was partly constructed, and were filled to some extent by riprap stone taken from the sides of the cribs.

Three of the cribs were carried away before operations were resumed in the following fall, and after having withstood the high seas of winter. Their loss was undoubtedly caused by having been made top-heavy from addition of boxes of ballast, and from having been weakened by loss of riprap stone from the sides.

The breaks in the jetty subsequently were filled by dumping stone in them at an expense to the United States which otherwise would have been unnecessary.

JETTY AT THE ENTRANCE TO YAQUINA BAY, OREGON.

Considerable damage was done to the piling of the tramway of this work by trees and logs which were thrown into the bay and into Yaquina River, during the last summer, by constructing parties of the Willamette Valley and Coast Railroad Company, known as the Oregon Pacific. In May it was reported that one tree took out fourteen piles.

The company's agents endeavored to dispose of a lot of its drift by rafting and towing it to the entrance. The raft broke up and was carried back by the return tide, doing damage to the jetty piling to the extent of over $1,000.

The jetty was commenced in 1881, and had not suffered any noticeable injury previous to the cases mentioned, nor since. The drift floating down the bay was a danger to all passing vessels. The United States tug *Wright* damaged her wheel by this railroad drift, so that she had to be beached twice for repairs.

* * * * * * *

The jetties at the mouth of the Coquille River, and at the entrance to Coos Bay, have been seriously damaged by drift, partly composed of trees, which have been fallen over the banks of tributary streams in land clearing.

* * * * * * *

Very respectfully, your obedient servant,

Chas. F. Powell,
Captain of Engineers.

The Chief of Engineers, U. S. A.

LETTER OF THE SECRETARY OF WAR.

War Department,
Washington City, January 3, 1888.

The Secretary of War has the honor to transmit to the House of Representatives a letter of the 24th ultimo from the Chief of Engineers, together with copies of reports from such officers in charge of river and harbor districts as report instances of the use, or the occupancy of, or injury to, public works; the same being transmitted in response to the requirements of section 4 of the river and harbor act of August 5, 1886.

William C. Endicott,
Secretary of War.

The Speaker of the House of Representatives.

LETTER OF THE CHIEF OF ENGINEERS.

Office of the Chief of Engineers,
United States Army,
Washington, D. C., December 24, 1887.

Sir: Section 4 of the river and harbor act of August 5, 1886, requires of the Secretary of War that he shall "report to Congress all cases in which piers, breakwaters, locks, and dams, or other structures or works, built or made by the United States in aid of commerce or navigation, are used, occupied, or injured by a corporation or an individual, and the extent and mode of such use, occupancy, or injury."

With the view of supplying the required information officers and agents, under the direction of this office, were instructed to submit detailed reports covering all facts necessary to enable the Secretary of War to comply with the terms of the act.

Reports have been received from all officers in charge of river and harbor districts; and I have the honor to submit herewith copies of such of them as report instances of the use, or the occupancy of, or injury to public works.

All other officers state that there are in their districts no such instances to report.

Very respectfully, your obedient servant,

J. C. DUANE,
Brig. Gen., Chief of Engineers.

Hon. WM. C. ENDICOTT,
Secretary of War.

REPORT OF MAJOR W. R. LIVERMORE, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Newport, R. I., July 7, 1887.

SIR: Referring to General Orders, No. 6, Headquarters Corps of Engineers, current series, I have the honor to state that there is no structure or work in this district built or made by the United States in aid of commerce or navigation which is used or occupied by a corporation or an individual except the Government wharf in the inner harbor at Block Island, R. I. This is the only wharf on the island available, except in summer, and it is used by the Government and the public in common.

Pursuant to a recommendation contained in the Annual Report of the Chief of Engineers for 1886, a clause was inserted in the river and harbor bill considered during the last session of Congress, providing for the transfer of this wharf to the town of New Shoreham (the corporate name of Block Island), for the public use of said town, but the bill did not become a law.

Very respectfully, your obedient servant,

W. R. LIVERMORE,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL WALTER McFARLAND, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
New York, N. Y., July 19, 1887.

GENERAL: Under section 4 of the act of Congress relating to rivers and harbors approved August 5, 1886, I have the honor to report as follows upon the use by corporations or individuals of works built or made by the United States in aid of commerce or navigation in the engineer district of which I have charge.

Very respectfully, your obedient servant,

WALTER McFARLAND,
Lieut. Col. of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT UPON THE USE, OCCUPATION, OR INJURY BY CORPORATIONS OR INDIVIDUALS, OF PIERS, BREAKWATERS, OR OTHER STRUCTURES OR WORKS BUILT OR MADE BY THE UNITED STATES IN AID OF COMMERCE OR NAVIGATION.

The only instances of this kind in this district are found in connection with the dikes on the Upper Hudson.

1. Miller and Whitbeck have built a dock over 273 feet of the half dike at Mull's Island, on the east side of the river, about 13 miles below the railroad bridge at Albany. The dike just above the dock has been heavily loaded with stone to serve as an ice-breaker, and shows signs of giving way under the weight imposed on it.

This occupation of the dike was authorized by the honorable Secretary of War November 9, 1880, under an opinion of the Judge-Advocate General of the Army.

2. H. Slingerland has built a dock over 103 feet of the Barren Island Dike opposite Coeyman's, on the west side of the river, about 12½ miles below the railroad bridge at Albany. It is not known under what authority this was done.

3. The Knickerbocker Ice Company occupy with their wharf 319 feet of the Roah Hook Dike, on the west side of the Hudson River, about 12 miles below the railroad bridge at Albany, by authority of the Chief of Engineers under the opinion of the Judge-Advocate-General of the Army, before referred to—October 12, 1880.

4. F. E. Bean uses for a dock 259 feet of the Castleton Dike, on the east side of the river, about 9 miles below the Albany railroad bridge. The dike is much broken for about 20 feet above the upper end of the dock. This occupancy is under authority of a grant of lands under water by the State of New York, over which this United States dike is built.

5. E. P. Stimson occupies for dock purposes 280 feet of the Castleton Dike, about 400 yards above the part occupied by F. E. Bean, under approval of the Chief of Engineers dated September 11, 1871. The dock is not now used and has fallen into decay.

6. The Ridgewood Ice Company occupy the lower end of the Cedar Hill Dike, on the west side of the river, opposite Castleton, about 8½ miles below the railroad bridge at Albany, under authority of a grant of lands under water made by the State of New York, upon which this United States dike is built.

7. Sunny Side Ice Company occupy for dock purposes a part of the dike in front of Cow Island, on the east side of the river, about 7½ miles below the railroad bridge at Albany, under what authority is not known.

8. Richard English occupies for dock purposes 203 feet of the Campbell Island Half-dike, on the east side of the river, about 7½ miles below the railroad bridge at Albany, under authority of a grant of land under water from the State of New York, this dike being built over that land.

9. Whitehead Brothers occupy for dock purposes about 25 feet of the Cedar Hill Dike, on the west side of the Hudson River, about 6 miles below the railroad bridge at Albany, under authority of the honorable Secretary of War, dated May 18, 1887.

10. Hotaling and Park (now Knickerbocker Ice Company) occupy a part of the old Beacon Island Half-dike, on the west side of the river, about 3½ miles below the railroad bridge at Albany, under what au-

thority is not known. Their occupancy of it has, however, improved it, as they have closed a break which formerly existed in it.

11. John Patterson has built a dock 100 feet long over the old revetment of Beacon Island, on the west side of the Hudson, about 600 yards above Hotaling and Park's ice-house, under approval of the Chief of Engineers, dated December 16, 1881.

12. Paul S. Forbes has built a dock over a part of the Bath Dike, on the east side of the river, about 1½ miles above the lower railroad bridge at Albany, under agreement and bond transmitted to the Chief of Engineers October 28, 1876.

The dock has not been kept in repair and the dike has given way under it.

13. W. H. Forbes has extended the dock built by Paul S. Forbes about 225 feet further north over the Bath Dike. The occupation of this dike was approved by the honorable Secretary of War June 15, 1882.

14. George Mark and others have built a dock over the old revetment of Patroon's Island, on the west side of the river, about 2½ miles above the lower railroad bridge at Albany, extending out into the river about 60 feet beyond mean high-water mark, without any authority other than that derived from the old colonial grant to the patroon.

15. Erastus Corning has occupied for dock purposes 105 feet of the high dike between Hillhouse and Patroon Island, on the west side of the river, about 3½ miles above the lower railroad bridge at Albany, under authority of the Hon. Secretary of War dated June 15, 1882.

16. Corning and Company, under authority of a grant of lands under water from the State of New York, have for some years been filling in with ashes and slag from their works, a strip of this grant running south from their iron works, on the east shore of the river, just below Troy. They have gone outside the limits of their grant in some places, and none of the material dumped having any protection against the action of the current, much of it is carried away, especially during freshets, and is dropped in the channels which have been under improvement by the United States.

17. The Rensselaer Iron and Steel Company have built a dock over the Port Schuyler Dike, on the west side of the river, about 4½ miles above the lower railroad bridge at Albany, under authority of a grant of lands under water made by the State of New York.

The line of their dock is about 25 feet outside of the line of high water on the dike.

Under direction or by permission of the State officers, the dikes have been cut at various times to permit the passage of scows loaded with dredged material to be dumped behind the dikes. Sometimes these cuts are afterwards closed—sometimes not. The authority of the United States over these dikes appears to be disregarded by the State officers.

Respectfully submitted,

WALTER MCFARLAND,
Lieut. Col. of Engineers.

REPORT OF LIEUTENANT GEORGE McC. DERBY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, November 1, 1887.

GENERAL: In compliance with General Orders No. 6, Headquarters Corps of Engineers, June 1, 1887, I have the honor to report that the only instances in which structures built by the United States in aid of navigation in my district are used, occupied, or injured by a corporation or an individual are the following:

I.—SOUTH RIVER, NEW JERSEY.

a. Messrs. Sayre & Fisher, brick-makers, have filled in between their property and Dike A of this improvement, and use the dike for a wharf for a length of about 300 feet.

b. About the same length of Dike E is put to the same use by W. F. Fisher, brick-maker.

These parties have been notified that their use of the dikes is unauthorized, and it is their intention to make application for permission to use them on the same conditions as to keeping them in repair that similar permits have been granted on for the use of the dikes in the Hudson River.

II.—RARITAN RIVER, NEW JERSEY.

At Dike A, in "Deep Bend," on this river, a line of narrow-gauge railroad track, communicating with the works of the New York Fire-Brick Company, has been laid across the dike, terminating at a wharf known as Holcomb's Wharf, which has been built along the outside of the dike for a distance of 100 feet, and projecting into the river a distance of 25 feet beyond the line of the dike. Between the railroad track and the wharf about 200 feet of the dike are occupied.

The building of this wharf was approved by Lieutenant-Colonel Gillespie, Corps of Engineers, May 25, 1885.

In this connection I would mention that it is claimed here that where the United States has not obtained from the State in which the structure is built a grant for the land under water on which the structure stands that private parties can at any time obtain such a grant, and that this grant carries with it the ownership of any dike or structure occupying the area granted, as well as any adjoining land which may have been formed by the effect of the dikes on the currents of the stream.

In some cases the dikes and the land they have formed are quite valuable, and if they are to be allowed to pass out of the control of the United States, some proportion of their cost might be recovered by obtaining the grant for the land on which they stand from the State, and then selling them to the highest bidder or leasing them to private parties.

I am not aware whether the claim above referred to is considered good, but considerable trouble in the future might perhaps be avoided by making the title of the United States secure at once, whether by obtaining grants from the State or by Congressional action.

Instances of dikes in my district that have already considerable value as real estate, and will steadily become more valuable, are those at the junction of the north and south branches of the Shrewsbury River, and the one at the mouth of the Passaic River, in Newark Bay.

Very respectfully, your obedient servant,

GEO. McC. DERBY,
Lieutenant of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL HENRY M. ROBERT, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Philadelphia, Pa., December 29, 1886.

SIR: I have the honor to submit the following report, in compliance with General Orders No. 6, Headquarters Corps of Engineers, U. S. Army, November 29, 1886, relative to "all cases in which piers, breakwaters, locks, and dams, or other structures or works built or made by the United States in aid of commerce or navigation are used occupied, or injured by a corporation or an individual, and the extent and mode of such use, occupation, or injury."

The works in this district to which the above would apply are the Ice-Harbor at Marcus Hook, Pa., and Delaware Breakwater Harbor, Delaware.

At Marcus Hook the works of the United States consist of two land piers about 600 feet apart and seven detached piers in the river. Collectively these piers form the ice-harbor at this locality. The upper land pier is used by small steamers running between Philadelphia and points on the river below, in making landings at Marcus Hook for freight or passengers. This use of the pier is without injury to the works of the United States.

The harbor is considerably used during the season of ice in the river by the city ice-boats of Philadelphia, and complaint has been made that during the winter the value of the harbor for the purposes for which it was constructed is seriously interfered with, from its use by the owners of small craft as a permanent winter harbor for their vessels.

At Delaware Breakwater Harbor the works of the United States consist of two detached breakwaters of random stone. The Maritime Exchange of Philadelphia has established a station on the breakwater, with telegraphic communication with the mainland, using the engineer building thereon as quarters. The privilege for such occupancy was granted, with the approval of the Chief of Engineers, under date of July 8, 1885. The station is of great value to the commerce of the Delaware River, and the occupation of the breakwater is without injury to the works of the United States.

Very respectfully, your obedient servant,

HENRY M. ROBERT,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., January 6, 1887.

GENERAL: In response to General Order No. 6, series of 1886, from your headquarters, I have the honor to submit the following report:

None of the "piers, breakwaters, locks, and dams, or other structures or works built or made by the United States in aid of commerce or navigation" on any of the rivers and harbors under my charge, have been "occupied by a corporation or an individual."

All of such structures or works have been daily "used" by corporations and individuals, but only in the way in which they were intended to be used—"in aid of commerce or navigation."

In such use, some injury has been done, but nothing more than that due to the ordinary wear and tear to be expected.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

SUPPLEMENTAL REPORT OF LIEUTENANT-COLONEL WILLIAM P. CRAIGHILL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Baltimore, Md., January 25, 1887.

GENERAL: On further reflection it seems that I should add to my report of January 6, made in compliance with General Order No. 6, series of 1886, from your office, the statement that the United States land at Site 6, Great Kanawha River, abutment side, has been for several years, and without proper authority, crossed by the track of the Kanawha and Ohio Railroad, which extends from Charleston along the right bank of the river to its mouth.

While this is technically a trespass no real injury has thus far resulted to the United States. It is supposed this crossing can only be authorized by Congress.

The company has made many promises to obtain the proper authority, but up to this time I have had no notice of the accomplishment of that object.

Very respectfully, your obedient servant,

WM. P. CRAIGHILL,
Lieut. Col. of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN F. A. HINMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Norfolk, Va., December 11, 1886.

GENERAL: In accordance with the provision contained in section 4 of "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved August 5, 1886, and promulgated in General Order No. 6, Headquarters Corps of Engineers, United States Army, current series, I have the honor to submit the following report:

The only case known to me in this district is that of the Lambert's Point light-house site in Norfolk Harbor (see accompanying map), which is "used and occupied" to a certain extent by the coal pier of the Norfolk and Western Railroad Company, that extends from the mainland out to the light-house. It is understood that this is done by permission of the proper authority, and that the property is not injured thereby.

Very respectfully your obedient servant,

F. A. HINMAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF COLONEL Q. A. GILLMORE, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
New York, November 5, 1887.

SIR: In compliance with General Orders No. 6, Headquarters Corps of Engineers, series 1887, on the subject of piers, breakwaters, locks, dams, etc., built or made by the United States in aid of commerce or navigation, and used, occupied, or injured by a corporation or an individual, etc., I have the honor to report as follows, viz:

SAVANNAH HARBOR AND RIVER, GEORGIA.

The works of improvement known as "Cross Tides Dam," "Fig Island Jetty," "Philbrick's Cut Dam," and "Big Gap Dam," all located within a few miles of the city of Savannah, have been repeatedly injured to some extent by the removal of portions of the riprap stone used in their construction. The stone is thrown off the dams by unknown persons to permit the passage of small boats.

ALTAMAHA RIVER, GEORGIA.

The training-wall built by the United States at Beard's Bluff Bar has been damaged by unknown persons, by the removal of riprap stone from the crest, to afford passage for small boats.

The above are the only instances known to me in which works built by the United States in aid of commerce or navigation have been "used, occupied, or injured."

Very respectfully, your obedient servant,

Q. A. GILLMORE,
Colonel of Engineers,
Bvt. Maj. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN W. M. BLACK, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Jacksonville, Fla., July 20, 1887.

SIR: In compliance with General Orders No. 6, Headquarters Corps of Engineers, Washington, June 1, 1887, I have the honor to report as follows, viz:

The small house and wharf erected on the piles over the east jetty at Volusia Bar, St. John's River, Florida, by Mr. Falana, and occupied by him as light-keeper for the steamboat companies, as reported by Capt. William T. Rossell, Corps of Engineers, January 20, 1885, still exists. Since the establishment of Volusia Bar Lights by the United States Mr. Falana has been employed as tender to the range-lights.

No injury has resulted to the works at Volusia Bar by reason of this occupation.

In Saint Augustine, Fla., six wharves, two houses, and three sets of ways for repairing vessels have been built over and against the sea-wall built by the United States in 1841 to 1854. Permits for building some of these wharves, etc., have been issued by the city authorities. Under the law of the United States and of the State of Florida, the

United States owns the riparian rights along the entire length of this wall. No special injury is done to the wall itself by these structures.

Very respectfully, your obedient servant,

W. M. BLACK,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR A. N. DAMRELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Mobile, Ala., July 22, 1887.

SIR: In compliance with General Orders No. 6, dated June 1, 1887, I have the honor to submit the following report:

In January, 1883, "Farr Slough," situated about 44 miles above the mouth of Pearl River, Mississippi, and 271 miles below Jackson, Miss., was closed under direction of Maj. Amos Stickney, Corps of Engineers, by driving piles across the head and felling large trees into the slough immediately below the piling, in order to confine all the water of the main river in one channel.

During the months of December, 1884, and January, 1885, Mr. —— Weston, a saw-mill owner, at Logtown, on East Pearl River, removed a number of these piling, cut the balance down to a dead low-water level, and removed the trees felled in below. He also removed, by blasting, the greater part of an island situated at the head of the slough, so as to open a clear channel for running saw-logs to his mill.

Since the opening of this slough by Mr. Weston, that portion of the main river immediately below the slough down to Home's Bayou, a distance of 6 miles, has shoaled considerably, as it is estimated that fully one-half of the volume of water goes through the slough and is lost to that part of the river used for purposes of navigation.

Very respectfully, your obedient servant,

A. N. DAMRELL,
Major Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN SMITH S. LEACH, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., June 21, 1887.

SIR: Referring to General Orders No. 6, Headquarters Corps of Engineers, current series, I have the honor to state that the only work under my charge which is used or occupied by individuals or corporations is the levee on the Plumb Point Reach, which is used by the community generally as a foot-path, by which use no injury is done. A small part of this levee was built on the line of an old turnpike, and this portion is occasionally driven over by persons who have not become acquainted with the new road provided. No appreciable injury has been done as yet by this use, nor is any likely to be.

Very respectfully, your obedient servant,

SMITH S. LEACH,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN WILLIAM T. ROSSELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Memphis, Tenn., July 20, 1887.

SIR: In obedience to General Orders No. 6, Headquarters Corps of Engineers, United States Army, Washington, D. C., June 1, 1887, I have the honor to report as follows:

The only public works built or made by the United States in aid of commerce and navigation injured by the people are the levees.

These are used as public roads, and by this means are gradually worn down. Horses, cattle, and hogs are allowed on them, doing much damage, especially the latter.

There are in existence State laws under which these affairs come, but in many cases they are not fully enforced.

Very respectfully, your obedient servant,

WM. T. ROSSELL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR CHARLES J. ALLEN, CORPS OF ENGINEERS.

ENGINEER OFFICE, UNITED STATES ARMY,
Saint Paul, Minn., July 5, 1887.

SIR: I have the honor to submit the following report, in obedience to General Orders No. 6, Headquarters Corps of Engineers, Washington, D. C., June 1, 1887. The report covers facts to date.

FALLS OF SAINT ANTHONY, MINNESOTA.

The preservation of the Falls of Saint Anthony was undertaken by the United States in 1870, since which time the Government has expended upon this work, including a sluice for the passage of saw-logs, $615,000. The plea for the appropriations was that the destruction of the falls would be followed by destruction of navigation on the Mississippi River above them. There has not been, however, any navigation by steamboats for 76 miles above the falls for several years past. The works constructed by the Government at the falls are:

1. A concrete dike underneath the limestone ledge extending across the river along a line a short distance above the crest of the falls, to cut off seams and strata which might permit the passage of water through the sand-rock underlying the limestone.
2. A timber apron and wing, to prevent the wearing away of the sand-rock at the foot of the falls and consequent recession of the limestone ledge.
3. Two folding dams, designed to maintain during the winter sufficient depth of water upon the limestone ledge to prevent injurious action upon it of frost and ice.
4. A sluice at the west side of the apron for the passage of saw-logs.

The concrete dike and the flooding-dams were completed in 1876, the timber apron and wing in 1878, and the log-sluice in 1879. The appropriations by Congress since 1878 (that for the log-sluice excepted) have been applied in repairing and strengthening the apron and wing.

In the fall of 1881, and during the winter following, one Bassett, of Minneapolis, and others associated with him, deposited large quantities of rock, gravel, and earth in the main channel of the river on the west side and just above the apron. The material thus deposited was at one point 18 feet in height above low water and formed an immense dike, narrowing the channel width by 118 feet. The effect of the deposit was not only to practically block the entrance to the log-sluice, but also to concentrate the flow of water into the easterly angle formed by the apron and wing, the weakest and most exposed point of the works. The floods of the following spring worked great injury to the apron and wing in consequence, and extensive repairs and additions to the defensive works became necessary on the part of the Government.

During the winter of 1881 and 1882 an attempt was made by parties claiming the right to the water-power on the east side of the river to tunnel under what is known as Farnham and Lovejoy's mill-pond at a point about 50 feet below (down-stream from) the United States works, the object being, apparently, to obtain a race under that pond. This attempt was, however, discontinued in consequence of an injunction served at the instance of Farnham and Lovejoy, or by their attorney.

The tunneling, however, progressed far enough to expose a small face of the sand-rock to the action of high water, and the erosion has, since the winter of 1882, caused a recession of the limestone ledge at this point of about 40 feet.

As this recession approaches the United States works the latter are more and more endangered.

As soon as Mr. Bassett's action was discovered he was notified to desist. As he persisted in depositing the material, the case was referred to the Department of Justice, and about the 1st of April, 1882, proceedings were commenced before the United States district court to compel the removal of the material.

After the taking of long and tedious testimony the deposits were finally removed, as required, in the summer and fall of 1883. Mr. Bassett sustained some pecuniary loss in consequence of being obliged to remove the material. Beyond this nothing was done. The United States attorney, in January, 1882, expressed the opinion that no action under the law could be brought against Mr. Bassett further than that necessary to compel removal of the deposits.

This case was reported in the Annual Reports of the Chief of Engineers for 1882 and 1883; also in special letters from this office dated February 11, 1882, and April 30, 1882.

The running of loose saw-logs in large numbers over the apron, instead of through the sluice built for the purpose of receiving the logs in order to save the apron, occurred at different times between 1880 and 1882. The logs were sheered by the Mississippi and Rum River Boom Company into the pond of the Minneapolis Mill Company. From this pond they were to be sluiced over the falls, to be received by the Saint Paul Boom Company. The two companies, it appeared, differed as to the responsibility of driving the logs to the sluice; in consequence, many millions of feet of logs escaped over the apron, grinding and wearing the latter in their descent. In some cases it was claimed that the booms above the falls broke under the pressure of accumulations of logs and of freshets. An injunction was finally obtained from the United States court in March, 1882, restraining the running of logs over the apron, and the agent of the Minneapolis Mill Company shortly afterwards connected the company's pond with the sluice, thus reducing the trouble from the logs. During the summer of 1885, however, large numbers of logs were turned over the apron. The matter was referred to the then United States district attorney, who, after investigation, appeared to be of opinion that the logs were not intentionally turned over the falls by their owners. During the summer of 1886 some saw-logs were also turned over the apron.

MISSISSIPPI RIVER, ABOVE THE FALLS OF SAINT ANTHONY, MINNESOTA.

From such information as I can gather, it appears that in the spring of 1875 lumbermen cut the brush and stone dams constructed by the Government for the improvement of navigation at the Thousand Islands, near Saint Cloud. The dams were broken through in order to get the logs out of the pockets formed by the dams and islands, that mode of procedure being more profitable to the lumbermen than taking the logs out in any other way.

It also appears from the records of this office that in the spring of 1878 log-drivers committed similar depredations at the dams constructed by the Government at Brown's Island, Haughton's Flats, and Lily Pond Islands. Also, that the drivers pulled down several of the sign-boards placed at these dams, these sign-boards having lettered on them an extract from the act of Congress approved August 14, 1876, prescribing the penalty for such depredations.

The officer in charge, Major Farquhar, represented the matter of the damage to the work at Haughton's Flats to the Department May 21, 1878, and, at the request of the Chief of Engineers, the honorable Attorney-General, on the 3d of June, directed the United States attorney for Minnesota to examine into the matter. It seems that satisfactory evidence could not be produced against the guilty parties.

THE YELLOW BANKS, CHIPPEWA RIVER, WISCONSIN.

During the fall of 1885, or the winter following, some of the timber ties of the protection wall at the Yellow Banks were stolen. Efforts were made to discover the guilty parties, but without success.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR JAMES C. POST, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cincinnati, Ohio, December 14, 1886.

GENERAL: In compliance with General Orders, No. 6, current series, Corps of Engineers, I have to report that so far as can be ascertained there are no "piers, breakwaters, locks, and dams, or other structures built or made by the United States in aid of commerce or navigation used, occupied, or injured by a corporation or an individual" in the district of which I have charge, except upon the Kentucky River at Dam No. 4.

The State of Kentucky, in ceding the five locks and dams upon the Kentucky River to the United States in 1880, reserved the right or privilege of the Kentucky River Mills to use the water-power at Dam No. 4, which right or privilege was granted the said corporation before the act of cession for ninety-nine years, beginning July 10, 1878. Since this dam has been in the possession of the United States it has been rebuilt, the corporation named bearing the expense of the repairs required, at the same time, on that portion of it where the water is taken from the pool for their benefit. The act of the State of Kentucky granting the privilege provides:

> That in the erection of such structures and the construction of such flumes and other appliances the said Kentucky River Mills are to be responsible for any injury to said dam arising therefrom: *And provided further,* That they are not to have or use said water to the prejudice and injury of the navigation of said river, it being distinctly understood that it is the surplus water which can be spared from the dam without injury to navigation that is hereby leased and conveyed.

This company occupies 10 acres of land which formerly belonged to the State of Kentucky, but under the act of cession became the property of the United States, and lies adjacent to the abutment end of the dam. For the privileges granted as stated the company were to pay to the commissioners of the sinking fund of the State $180 annually upon the 1st day of July until the end of the term of the lease. No rental has been collected by the Government since it has had possession of the locks and dams.

Very respectfully, your obedient servant,

JAS. O. POST,
Major of Engineers.

Brig. Gen. JAMES C. DUANE,
Chief of Engineers, U. S. A.

REPORT OF MAJOR AMOS STICKNEY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Louisville, Ky., February 4, 1887.

GENERAL: I have the honor to report that there are no known instances of injury by individuals or corporations of structures or works built or made by the United States in aid of commerce or navigation within the district under my charge. There are a number of instances of occupation of ground belonging to the Louisville and Portland Canal as detailed in appended report of Mr. Thos. H. Taylor, superintendent of the canal. The occupation of this ground in no wise interferes with the navigation of the canal.

Very respectfully, your obedient servant,

AMOS STICKNEY,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MR. THOS. H. TAYLOR, SUPERINTENDENT LOUISVILLE AND PORTLAND CANAL.

LOUISVILLE, KY., *January* 4, 1887.

SIR: Below please find report in answer to your letter and in compliance with provision of the river and harbor act of 1886.

Beginning at the head of the canal, first, a basin on south side canal about 80 feet by 450 feet was excavated and is in use by Byrne and Speed, lying between railroad bridge at Fifteenth street and the upper guard gates of the canal. A coal elevator at Fourteenth street, 250 by 40 feet, is also built on canal grounds, and is in use by same parties. The right to the occupancy was granted by the Louisville and Portland Canal before it became Government property, and license, since acquired, has been granted and continued by the United States Government or its agents. This is all on the south side. The Louisville Cement Company occupy on north side above the Eighteenth Street Bridge about 100 by 150 feet, on which are erected some frame sheds for storage of staves and heading for the barrels in which is packed the cement, for use of which they pay $30 per year. The company has a narrow-guage road over which is hauled the rock from their quarry above the railroad bridge to their mill in Shippingport, passing a short distance below the Eighteenth Street Bridge along the Shippingport road on canal ground, and has been so used for fifteen years. The Union Cement Company, by license granted by Honorable Robt. T. Lincoln, Secretary of War, November 11, 1884, have the use of a certain lot or parcel of land, lying and situate as herein described, beginning at a point on the north property line of the Louisville and Portland Canal 220 east of a stone in said line common to the Louisville Cement Company and the Union Cement and Line Company, thence at right angles with said property line south 48° 50′ west 70 feet, thence parallel with 70 feet from said property line south 41° 10′ east 145 feet, thence at right angles west 48° 50′ east 70 feet, thence with said property line north 41° 10′ west to the beginning, for use and occupancy of which the said company pay $5 per annum. This license to be subject to withdrawal at any or all times. Both of these companies have a runway over the canal bank to the water by which they load the cement on boats, license for these, granted by Colonel Merrill, Corps of Engineers, United States Army, revocable at any time. The K. and I. Bridge Company Railroad are partly on canal property, around what is known as the Skene property, and occupy some of the canal ground between Thirty-second and Thirty-third streets for piers and trestle-work of bridge, license for use of which was granted by Secretary of War. On the canal land opposite lower basin at the locks is an old building belonging to the canal, which is leased to W. H. Slaughter for $62.50 per annum, and used as pipe works.

Respectfully,

THO. H. TAYLOR,
Superintendent Louisville and Portland Canal.

Major AMOS STICKNEY,
Corps of Engineers, U. S. A.

REPORT OF CAPTAIN JAMES B. QUINN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Duluth, Minn., January 10, 1887.

GENERAL: In pursuance with instructions contained in General Order No. 6, Headquarters Corps of Engineers, Washington, November 29, 1886, I have the honor to report that the only damage to Government piers or other constructions for the benefit of navigation in my district resulting from collisions or other similar causes was a damage valued at about $200, caused by the steam barge *Iron Chief* colliding with the south pier of the Duluth Canal or harbor entrance. From all the information I have been able to collect, this collision appears to have been accidental and due to the vessel refusing to answer her helm in consequence of a current out, deflecting the vessel out of its course.

Very respectfully, your obedient servant,

JAMES B. QUINN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CHARLES E. L. B. DAVIS, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., June 9, 1887.

SIR: In accordance with General Orders No. 6, Headquarters Corps of Engineers, United States Army, Washington, D. C., June 1, 1887, relative to section 4 of the act of August 5, 1886, making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes, I have the honor to submit herewith reports upon the use, occupancy, or injury by a corporation or an individual of piers, breakwaters, etc., built by the United States in aid of commerce or navigation at the following harbors under my charge

Marquette Harbor, Michigan; Menomonee, Ahnapee, Manitowoc, and Sheboygan Harbor, Wisconsin.

Very respectfully, your obedient servant,

CHAS. E. L. B. DAVIS,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

SHEBOYGAN HARBOR, WISCONSIN.

About 220 feet of the north pier at this harbor is used by fishermen in removing fish from their boats to fish-houses, but without damage to the pier. These fish-houses are situated on the beach that has formed since the piers were built, and rent is paid for their use to the owner of the land. It is understood that the portion of the pier inside of the shore-line was ceded to this owner on condition that it should be kept in repair without expense to the United States.

About 200 feet of the south pier was for many years occupied by the Sheboygan and Fond du Lac (now Chicago and Northwestern) Railroad Company.

It is understood that the railroad company holds a perpetual lease from the city of Sheboygan for this portion of the pier upon the condition of keeping it in repair. It is now in a dilapidated condition, and apparently abandoned by the railroad company. It should be placed in good repair by the local authorities or the railroad company. The United States has not rebuilt the superstructure over this part of the pier, or, so far as known, made repairs to the same.

MANITOWOC HARBOR, WISCONSIN.

The Goodrich line of steamers use the five inner cribs at this harbor for a permanent landing wharf. As the company keeps this portion of the pier in repair, and as these cribs are now entirely within the shore-line, there seems to be no objection to such occupancy by the steamboat company.

AHNAPEE HARBOR, WISCONSIN.

In the river and harbor act of August 5, 1886, there is a proviso that no part of the money appropriated for improving the harbor at Ahnapee shall be expended until the wharfage over the Government piers at that port shall be made free.

The south pier at this harbor is used as a landing dock by the steamboat, which stops there six times a week. The owner of the land on both sides of the harbor piers has a warehouse just in rear of this pier and makes certain charges for handling freight. These charges are denominated "Ours" on the bills, and it was thought were warehouse and storage charges, and not wharfage, but Mr. O. G. Boalt, the owner of the land and warehouse in question, has asserted distinctly that his charges are for wharfage; so further work at this harbor is at present stopped.

MENOMONEE HARBOR, WISCONSIN.

The Menomonee River Lumber Company have been in the habit, for several years past, of using the south pier at this harbor for storing lumber, which is piled from 12 to 16 feet high, leaving a clear space of about 2 feet in width on the channel side, but projecting many feet beyond the south or lake side of the pier.

The pier is also used for mooring their barges while being made up into tows, the pounding of which does some damage to the piers in rough weather.

This unauthorized and improper use of the south pier was referred to in my annual report for the year ending June 30, 1886, in which I recommend that the Government should suspend further work at this harbor unless the practice was discontinued.

MARQUETTE HARBOR, MICHIGAN.

The Common Council of the city of Marquette passed an ordinance September 4, 1886, establishing harbor limits within which riparian owners were to be allowed to erect docks, wharves, and other structures.

In accordance with instructions of the Department, I made a report upon these harbor limits established by the common council in a letter dated October 18, 1886. This report was to the effect that the lines laid down were injudiciously established, were a serious encroachment upon the available harbor space, and very detrimental to the use of the harbor as a harbor of refuge.

In a report upon this same subject, dated December 13, 1886, I stated:

> George L. Burtis has a lumber wharf at this harbor, built parallel to the breakwater for a distance of 547 feet, with an ell at right angles extending within 60 feet of the breakwater, inclosing an area of six acres adjacent to the shore-end of the breakwater. In addition to this, in summer a log-boom is established inclosing about four acres more, one end of the boom being chained to the snubbing-post of the breakwater. The wharf and boom thus extend along more than one-half of the length of the breakwater.

Since then Burtis has built another dock 412 by 100 feet, 65 feet beyond his lumber wharf, thus further encroaching on the available harbor space.

REPORT OF CAPTAIN W. L. MARSHALL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., January 10, 1887.

SIR: In accordance with the requirements of General Orders No. 6, Headquarters Corps of Engineers, Washington, D. C., November 29, 1886, and of section 4 of the river and harbor act approved August 5, 1886, I have the honor to make the following detailed report for the works in my charge:

I. HARBORS OF RACINE, KENOSHA, AND MILWAUKEE, AND HARBOR OF REFUGE AT MILWAUKEE BAY, WISCONSIN, AND HARBOR OF WAUKEGAN, ILLINOIS.

None of the piers, breakwaters, or other structures built or made by the United States for the improvement of these harbors are used, occupied, or injured by any corporation or individual.

II. FOX AND WISCONSIN RIVERS, WISCONSIN.

Wisconsin River.—No use, injury, or occupancy of the works constructed on the river is made or maintained by indviduals or corporations.

Fox River from Portage to Green Bay, including the Portage Canal.—The works for the improvement of the Fox River create and maintain valuable water-powers at various points where dams have been built by the Government, which powers are used by the companies and individuals.

These water-powers were originally developed under charters to individuals and corporations, granted by the legislature of the State of Wisconsin, and when the various works for maintaining the slack water navigation of the Fox River passed by purchase from the Green Bay and Mississippi Canal Company into the hands of the United States, in 1872, the water-powers created by them were not purchased by the Government, but remained in the possession and use of the owners thereof at the time of the purchase. Since the purchase by the United States many of the works have been rebuilt, but no new water-powers have been created, nor any power then existing increased by raising the height of dams or otherwise. The right to use the water-powers maintained by the works is subject to the requirements of navigation, *i. e.*, only the surplus water not needed for navigation can be taken.

During the past low-water season (1886) the mills taking water from the pools above the Appleton, Kaukauna, and Menasha dams took water in excess of the low-water discharge of the Fox River, thus drawing down the levels of these pools below the crests of their respective dams, much to the injury of navigation, which was nearly entirely destroyed, and to the injury of the dams themselves, by exposing their crests to the air and to consequent decay. A demand was made upon these millers to cease taking water when the levels were reduced to the crests of the dams, which request was disregarded, and on my application, approved by the War Department, the Department of Justice has instituted proceedings in the United States (circuit) court for the eastern district of Wisconsin against the water-power owners at Neenah and Menasha as a test case, to protect the rights of the public and of the United States against this practice of the mills, and to define the limit below which the mills can not take water for hydraulic purposes.

The water is taken from the river and canals by the parties entitled to its use at their own expense, and the flumes, where they cut through the Government works, must be in accordance with plans approved by the United States officer in charge of the works, constructed so as not to injure or endanger the work.

The extent of such use of water-powers maintained by the Government is as follows:

On the Upper Fox there is one flour-mill at Montello, 25-horse power, the power being created by the dam now owned by the Government.

This mill is owned by Mary L. Lewis, and the power is leased from the Green Bay and Mississippi Canal Company.

On the Lower Fox, from Lake Winnebago to Green Bay, there is a large number of mills, a portion of which derive their water-powers from the public works, as follows:

AT MENASHA.

	Horse-power.
Jones & Holbrook, successor to P. V. Lawson, flour-mill	50
Henry Hewitt, jr., successor to Menasha Chair Factory	90
John Schneider, successor to Menasha Manufacturing Company, sash and doors	60
D. T. H. McKennon, successor to Davis & McKennon, Excelsior	80
C. R. Smith, barrels	80
Menasha Wooden Ware Company, pail factory	90
Menasha Wooden Ware Company, saw-mill	206
John Strange, saw-mill	187
W. P. Hewitt & Co., woolen-mill	53
James Little & Sons, machine-shop	19
Webster Manufacturing Company, chairs, hubs, and spokes	20
George Whiting, successor to Gilbert & Whiting, paper	250
Menasha Paper and Pulp Company, mill burnt down (lease)	150
Total at Menasha	1,335

In addition to above, Mr. P. V. Lawson has leased water-power to the Gilbert Paper Company on his canal, left side of the river, of 230 horse-power. The mill is now building.

The water-power is maintained by the dam and canal at Menasha, and was conveyed by the Fox and Wisconsin Improvement Company, a corporation created by the State of Wisconsin, to Charles Doty and Harrison and Curtis Reed, by a contract dated July 24, 1855. "It being the intent and meaning hereof to include all hydraulic rights on the dam and canal above the lock for all purposes, not to obstruct its navigation or impair said canal." The water-powers at Menasha are owned or leased by the successors of the said Doty and Reeds.

AT APPLETON, LEFT BANK OF RIVER.

	Horse-power.
Appleton Paper and Pulp Mill	300
Atlas Paper-Mill	400
Appleton Edison Light Company	35
Tirga Paper-Mill	250
Vulcan Paper-Mill	250
Water-Works Company	50
Total	1,285

This water-power was originally created by a wing-dam, built under the laws of Wisconsin by the riparian owner, Mr. Theodore Conkey. Afterwards, in 1852, when the State of Wisconsin built the upper dam at Appleton across the river, for the purposes of navigation, it was connected with this wing-dam. The present owners derive their title from Mr. Conkey. The power is now maintained by the Government dam.

APPLETON, RIGHT BANK.

	Horse-power.
Atlas Paper Company	700
Do	750
Appleton Boot and Shoe Company	10
Miller & Johnson, hubs and spokes	25
Appleton Electric-Light Company	200
L. A. Peifer & Co., tannery, burnt down	20
Walters & Bauer, toys, burnt down	25
Total	1,730

This power is maintained by the Upper (Government) Appleton Dam and the canal on the right side, and is leased or purchased from the Green Bay and Mississippi Canal Company.

AT APPLETON LOWER DAM.

	Horse-power.
Richmond Brothers, paper-mill, burnt down	150
Pride & Son, successor to John Kose, pulp-mill	400
Baune & Hume, flour	35
Eagle Fork Company, successors to John August	25
Electric Railway Company	200
Total	810

This power is maintained by the Lower Government Dam, and is leased from the Green Bay and Mississippi Canal Company.

AT LITTLE CHUTE.

	Horse-power.
John Verstegen, flour-mill	50

This power is maintained by the dam at Little Chute, and is leased from the Green Bay and Mississippi Canal Company.

AT KAUKAUNA, LEFT BANK.

	Horse-power.
A. L. Smith, successor to Franklin Mills Company, flour-mill	60
Kaukauna Paper Company, successors to H. A. Frambach (leased)	400
Kaukauna Lumber and Manufacturing Company, successor to Janson	50
American Pulp Company, successor to Doan & Hobery	200
Reuter Brothers (not running), hubs and spokes	50
Total	760

This water-power is created and maintained by the dam at Kaukauna, and is leased from the Green Bay and Mississippi Canal Company.

AT KAUKAUNA, RIGHT BANK.

	Horse-power.
Milwaukee, Lake Shore and Western Railway shops	80
Joseph Klein, flour	40
Bradner, Smith & Co., pulp-mill	400
Lind & Carlson, machine-shop	25
Badger Paper Company, paper and pulp mill	800
Total	1,345

This power is obtained partly from that created by the Kaukauna Dam, but mainly from the works of the Kaukauna Water Power Company, which is the successor to the Fox River Hydraulic Manufacturing Company, chartered under the general laws of Wisconsin, April 26, 1872.

AT LITTLE KAUKAUNA.

S. S. Clark, saw-mill, who had 25 horse-power in 1884, has his flume closed by an embankment.

This water-power is created by the dam at Little Kaukauna, and is leased from the Green Bay and Mississippi Canal Company.

AT DE PERE.

	Horse-power.
Arndt Bros. & Douseman, flour-mill	100
J. E. Dunham, flour-mill	100
Electric Light Company, successors to Novelty Manufacturing Company	25
Strenfield & Co., pump shop	25
H. Collette, owned by C. R. Merrill, shingle-mill	60
Fox River Iron Company, shut down	100
J. S. Monroe, burnt down, saw-mill	40
Gow & Co., not running	25
Total	475

This power is maintained by the dam at De Pere and by private parties. It is held under grant from the legislature of the State of Wisconsin, approved February 9, 1850, to Joshua F. Cox and his heirs and assigns forever, upon certain conditions as to the construction and maintenance of the lock, dam, and canal at the rapids at De Pere. The individual powers were purchased or leased from Cox and his successors.

As already stated, the Government or the public had suffered no injury up to July, 1886, and had been at no expense on account of these water-powers. They are held subject to the rights of navigation, but it appears that mill-owners refuse to acknowledge the decision of the officer in charge as to what the relative rights of the water-power companies and water-users and the public are. The mode, extent, and circumstances of the use of the water-powers for industrial purposes, as far as affects the interests of the Government and of the public in the navigation of the Fox River, will probably be authoritatively decided by the United States courts in the pending suit against the water-power users at Neenah and Menasha.

The owners of the water-powers under the State charter are inclined to sell or lease water privileges in excess of the low-water discharge of the Fox River, throughout the pools created by the dams on the Fox River, and can only be restrained in this vicious practice by legal process.

A copy of the bill in equity* of the United States against the Winnebago Paper Company *et al.* accompanies this report.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR THOMAS H. HANDBURY, CORPS OF ENGINEERS.

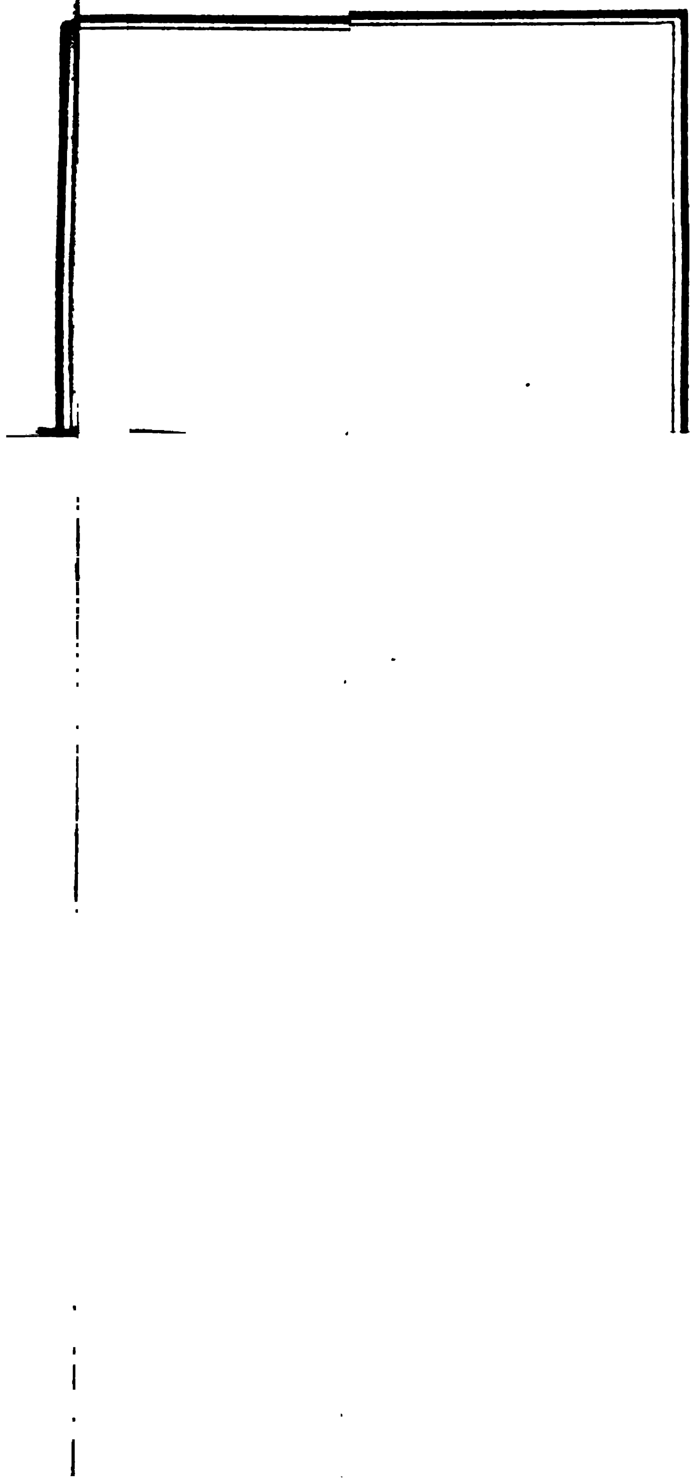
UNITED STATES ENGINEER OFFICE,
Chicago, Ill., December 24, 1886.

GENERAL: To comply with General Orders No. 6, Headquarters Corps of Engineers, United States Army, November 29, 1886, I have

---

*Omitted.

Nº 1.



Nº 2

OR, ILLINC

the U.S. Government

pied

s or Individuals

the honor to report as follows concerning the piers, breakwaters, etc., built by the United States in aid of commerce or navigation, and used, occupied, or injured by corporations or individuals.

The only work of the above nature now in my charge that will come within the purview of this order are certain of the piers in and about the mouth of Chicago River that have been built from time to time in aid to commerce and navigation. The conditions in relation to these are essentially the same as when reported upon by Major W. H. H. Benyaurd, December 19, 1884.

I inclose herewith a tracing showing the location and extent of the piers built by the United States that are now occupied or used by corporations or individuals, with the names of the parties so occupying or using them. To catch the eye conveniently these cribs are tinted yellow.

Prior to 1833 the Chicago River approached the lake near the present Illinois Central Railway lands, thence it turned south, and formed an outlet fully half a mile from its present mouth. The first improvement was commenced that year by makinga cut through the sand-bar that had been formed by the action of the waves produced by the northerly winds. This cut gave a straight outlet into the lake. About the same time a pier was constructed on the north side, beginning at a point on the line which is now the center of Pine street, and was about 1,000 feet in length. A pier was also constructed upon the south side of the river parallel to that upon the north side, a portion of which, however, was afterward removed and replaced by a crib structure further back. The two lines were continued eastward into the lake from time to time as appropriations were made therefor. East of the light-house on the north pier a portion of the crib-work was built by the city of Chicago. At some period the Illinois Central Railroad was allowed to cut through the south pier and construct slips A, B, and C, as shown upon the tracing.

During all these years the process of accumulation has been going on behind these piers, and by various processes much valuable land has become available for commercial and manufacturing purposes. A large amount of capital is invested here in these interests. The shore-line has moved far into the lake and the natural features of the situation entirely changed.

EXTENT OF CRIB-WORK OCCUPIED.

The crib-work on the north side of the river is entirely occupied by corporations and individuals, except the easterly 170 feet, which was built by the United States in 1859 for the foundation of the light-house. Commencing at the western end, the following is a list of occupants and the length of frontage occupied:

Occupants.	Occupations.	Extent.	Owners of adjacent land.
		Feet.	
Kirk & Company	Soap manufacturers	332	Kirk.
Brazil and Chicago Coal Company.	Coal	329	McCormick estate.
		125	Producers' Marble Company.
Peshtigo Lumber Company	Lumber	538	The land occupied by these firms is leased from the Chicago Canal and Dock Company.
C. J. L. Meyer	do	400	
John I. Culleton	Coal	152	
David Wylie	do	152	
Rathborne, Son & Co	Stove warehouse	58	
Fuller, Warren & Co	do	77	
Fitz Simons & Connell	Lumber	380	

On the south side the United States crib-work, on the westerly end for a distance of 270 feet, has been partially replaced by a substantial stone dock, with fender piling, built by the city of Chicago; thence easterly to Slip A the United States work has been reinforced by piling backed with sheeting.

The following is a list of occupants and the length of frontage occupied:

Occupants.	Occupations.	Extent. *Feet.*	Remarks.
Gooderich Steamboat Company		500	Owned by city of Chicago and Michigan Central Railroad.
Illinois Central	Railroad	219.5	
Do	do	121	
Do	do	148	
Lumber yards		257	Leased to occupants by the Illinois Central Railroad Company

The remaining portion of this south pier is reserved, as noted upon the tracing, for Government use. It is devoted generally to the storage of stone that is to be used for filling cribs.

The superstructure of these occupied cribs is, with the exception of one or two places, in need of general repairs, but the substructure, so far as I can ascertain, is in good condition, and there is every reason to believe that if let alone it will remain so for an indefinite time.

As an aid to navigation this work has accomplished well the object for which it was constructed, and since it is backed up by land now occupied by permanent buildings and industries it will continue to subserve this purpose equally as well as when first built, irrespective of the condition of the superstructure. No amount of money spent upon repairs to the superstructure of these cribs will be of any benefit to navigation in Chicago River. If the parties owning the abutting land and using these cribs desire the superstructure to be repaired in and of their own interests and industries, they should be permitted to do this in their own way and at their own expense.

The portion of the south pier reserved for Government use will before long need some repairs. This of course should be done at the Government expense.

Very respectfully, your obedient servant,

THOS. H. HANDBURY,
Major, Corps of Engineers.

Brig. Gen. J. C. DUANE,
Chief of Engineers, U. S. A.

REPORTS OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS.

1.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., December 13, 1886.

SIR: Referring to section 4 of "An act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved August 5, 1886, and in accordance with directions conveyed by General Orders No. 6, Headquarters Corps of Engineers, November 29, 1886, I have the honor to make the following report, viz:

At only two of the works committed to my charge are "piers, breakwaters, locks, and dams or other structures or works built or made by the United States in aid of commerce or navigation" * * * "used, occupied, or injured by a corporation or by an individual." * * *

(1) *At St. Mary's Falls Canal*, the water supply of the village of Sault Ste. Marie is taken by means of a pipe through the pier on the south side of the canal, near the western end, under permission granted by a revocable license dated December 8, 1885, signed by the Secretary of War.

By a revocable license dated July 31, 1886, the Secretary of War granted to the Board of Water Commissioners of the village of Sault Ste. Marie permission to lay water-mains through a certain portion of the grounds pertaining to St. Mary's Falls Canal.

(2) *On Saginaw River.*—The works at Carrollton have frequently been injured and partially destroyed by fire, caused by sparks from passing steam vessels, which use pine slabs for fuel and are unprovided with spark-catching devices.

The pier at Crow Island is often used by the boom companies and private parties as a mooring place for temporary storage of rafts of logs. An actual damage to the pier itself by reason of such use and occupation is not apparent, but the navigable channel opposite the pier is obstructed during such occupancy to the extent of the width of the rafts.

I am, sir, very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

2.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., August 8, 1887.

SIR: In compliance with the provisions of section 4 of the river and harbor act, approved August 5, 1886, I have the honor to report that the only cases in my district where "piers, breakwaters, locks, and dams or other structures or works built or made by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or by an individual," have occurred at St. Mary's Falls Canal.

First, use.—By permission of the War Department, the northwestern pier of the canal is used by the Sault Ste. Marie Bridge Company as a landing place for materials required in the construction of the bridge next referred to.

Second, occupation.—The Sault Ste. Marie Bridge Company, by virtue of authority granted by the Secretary of War, under section 2 of an act entitled "An act to authorize the construction of a railroad bridge across the Sainte Marie River," approved July 8, 1882, has entered upon the right of way across the canal and grounds, and is constructing the bridge provided for.

Third, injuries.—On October 15, 1886, the steam-barge *Smith Moore*, bound up, ran into the lower gate of the lock of 1881, while the lock was emptying, there still being a head of about three feet in the lock-chamber.

The boat pushed the gates open and forced her bow some 40 or 50 feet beyond the miter-sill, the result being to break the fastenings of one of the gate cables, warp the north leaf of the gate so that when afterwards closed the gate would not miter at the top by about 10 inches, start the tenons at the heel and toe posts, and injure three of the straps and ties.

When the gate was closed the water pressure due to the rising head in the lock chamber as it filled forced the distorted gate into position again, and the slight repairs to the iron work were quickly made, the whole cost not exceeding $30.

The injury arose from error on the part of the engineer of the barge, who misunderstood the correctly-given signals of the captain and turned the engine ahead when he had been signaled to back.

I am, sir, very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Brt. Brig. Gen., U. S. A.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF MAJOR L. COOPER OVERMAN, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Cleveland, Ohio, January 12, 1887.

GENERAL: In compliance with General Orders No. 6, Headquarters Corps of Engineers, United States Army, Washington, D. C., November 29, 1886, I have the honor to submit the following report:

MONROE HARBOR, MICHIGAN.

The bank of the United States Canal at this harbor is occupied by the Monroe Fishing-club houses. There are two or more buildings belonging to this club. There are also two fish-houses and two ice-houses, belonging to individuals, on the bank of the United States Canal. The occupation and use of said bank of canal is without permission, as far as records of the office show, but no especial injury to United States property is occasioned by the occupancy.

Would respectfully suggest that all parties trespassing be compelled to obtain written permission to so occupy the United States Canal bank, and be subject to the orders of "engineer in charge" of the harbor.

TOLEDO HARBOR, OHIO.

The United States has not built any "piers, breakwaters, or other structures" in aid of commerce or navigation for this harbor, hence there can not be occupancy or use of same by individuals or corporations.

SANDUSKY CITY HARBOR, OHIO.

Similar case to that at Toledo Harbor.

PORT CLINTON HARBOR, OHIO.

Piers, etc., built at this harbor by the United States are not used or occupied by any corporation or individual. Considerable trouble has been occasioned, at times, by parties removing sand (for sale) from off the narrow sand-beach which separates the river from the lake, at the inner end of the west pier. The parties removing the sand have permission from the owners of the beach.

It is respectfully suggested that some action of Congress should be had to protect the junction of piers, etc., with the shore or defining the right of the United States to control said beaches, which, in most instances, are the result of structures built by the United States for the improvement of the harbor.

* * * * * * *

CLEVELAND HARBOR, OHIO.

Piers and breakwaters *are* occupied and used both by individuals and corporations.

East Pier.—Occupied, in part, by the tracks of the Cleveland and Pittsburgh Railway Company, by special act of Congress, approved August 14, 1876, by which act the railroad company were to have use of and occupy part of said east pier, provided the railroad company should keep the pier in good condition.

It is respectfully suggested that the pier is not kept in good condition by the Cleveland and Pittsburgh Railway Company.

West Pier.—Occupied and used by club-houses of the "Gardner Canoe Club," of Cleveland, Ohio. Permission given by the honorable Secretary of War.

Occupied and used by Mr. Samuel Law, of Cleveland, Ohio, with boat-houses, where pleasure boats for fishing and rowing, etc., are kept for hire. Have so occupied and used part of said west pier for a number of years (over eight years). No record of any permission as to a sort of "squatter privilege," or by sufferance at first, which possession has strengthened.

The keeper of the "Life-Saving Station," which is located on the west pier, has constructed a dwelling-house and boat-house, where boats may be rented for pleasure. Permission given to erect said extra building by Col. John M. Wilson, Corps of Engineers (the then officer in charge), in October, 1882. Fishing boats land at or near the said boat-houses and give much annoyance at times, with unloading and dressing of fish.

Whilst these boat-houses, etc., which occupy and use the said west pier, do not materially injure said pier, their occupancy is a precedent for other parties who desire to get a foothold, and the trespassers already there make every effort to increase their privileges (?).

I would respectfully suggest that *all* parties now occupying this pier be given to understand that they are *trespassing*, be compelled to obtain permission to occupy and use said pier, and to be subject, in all respects, to the orders of "the engineer in charge" of the harbor.

Breakwater—Shore-arm.—On beach, near inner end of shore-arm, a boat-house, for hire of pleasure boats and sale of refreshments, was erected in the spring of 1884. Parties claim to have rented privileges of the owner of the land, but one of the houses is certainly on pile of riprap stone placed by the United States for protection of the junction of breakwater and shore. Their occupancy and use do not materially injure the breakwater, but it is an encroachment upon United States property which may become hereafter very objectionable. They should be placed subject to the orders of "the engineers in charge." The lake arm of the breakwater is not used or occupied in any way. It will, perhaps, be attempted by vessel men when the harbor of refuge is completed.

* * * * * * *

In conclusion I would respectfully suggest that it would be advisable if Congress should take some action, in a general act, giving the engineer in charge of any United States improvement some definite and fixed power to regulate the improper use ot piers, breakwaters, etc.

Very respectfully, your obedient servant,

L. COOPER OVERMAN,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN F. A. MAHAN. CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Buffalo, New York, November 1, 1887.

SIR: In compliance with General Orders No. 6, Headquarters Corps of Engineers, series of 1887, and with your letter of October 28, 1887, I have to report that the north pier at the mouth of Buffalo Creek is occupied by the Delaware, Lackawanna and Western Railway Company, for the use of their coal-pockets and tipples.

While the occupancy of the pier in this way does not inflict any directly apparent injury on the pier, still these structures are of such a nature as seriously to interfere with repairs that may be needed at any time and will be needed before very long, greatly increasing the cost of, and the time required in making such repairs.

The occupancy of this pier by the railway also seriously interferes with work going on under the auspices of the United States, as has been very well shown during the present summer and fall with the work going on at the breakwater.

The United States does not possess a single square foot of unoccupied ground convenient of access by water, except the banquette of the south pier, in the harbor of Buffalo. During the operations of the present summer and fall, the only place that could be found available for the storage of material was a pier belonging to the State of New York. This pier was used through the courtesy of the officials of the Erie Canal, but with the understanding that it *must be vacated on demand.* The pier was inconvenient of access, and it made necessary a double handling of all material arriving by rail, which would have been avoided had the United States been in possession of its own property.

If operations are to be continued on the breakwater during future seasons the use of a landing like this pier will be more and more necessary.

While the occupancy of the pier belonging to the State of New York did answer for the present season (in a certain way), it would not be sufficient for work on a large scale owing to lack of space for storage purposes, and it would be necessary for the United States to obtain, probably at great cost, a place suited to the demands of the work, while having a piece of property easily worth from $20,000 to $25,000 a year, if rented for a term of years, in its possession.

While the presentation of the above facts may not be just such as may be required by section 4 of the river and harbor act of August 5, 1886, it seemed to me proper to show how the interests of the United States suffer from the occupancy of a piece of its own property from which it obtains no return or compensation whatever.

Very respectfully, your obedient servant,

F. A. MAHAN,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF CAPTAIN CARL F. PALFREY, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
Oswego, N. Y., November 11, 1887.

GENERAL: In compliance with General Orders No. 6, current series, Headquarters Corps of Engineers, I have the honor to report the following occupation and injury of United States harbor works under my charge.

AT OSWEGO, NEW YORK.

December 10, 1886.—Extension of light-house pier was damaged by collision of steamer *Baltic* under stress of weather; four courses of timber on channel face were broken in, and the deck-plank secured to them were displaced and broken. Damage was repaired December 12–16, at a cost for material and labor of $92.08.

December 12, 1886.—Light-house pier extension damaged by collision of steamer *Bell Wilson* under stress of weather; three courses of timber on channel face were damaged and deck-plank displaced and broken. Damage was repaired December 13–16, at a cost for material and labor of $100.75.

September 12, 1887.—East breakwater damaged by collision with unknown vessel. Timber displaced and split and deck-plank started. Damage was repaired September 13, at a cost for material and labor of $7.60.

AT CHARLOTTE, NEW YORK.

In 1885 or 1886 the Ontario Beach Improvement Company rebuilt superstructure over about 600 feet of the old west pier within the present shore-line, as a revetment of the river front of lands leased by them, and have since occupied this as a private dock.

They have not held this as private property as against the United States, but complaints have been made through this office to the War Department of their so holding it as against private parties.

A chain ferry plying between the east and west piers, within the shore-line, authorized by the honorable the Secretary of War, May 24, 1873, is kept open during the summer.

A ferry plying between the east and west piers outside the shore-line was authorized by the honorable the Secretary of War, June 11, 1883. It is understood to be discontinued.

No other occupation or injury of United States harbor works under my charge is known to me.

I have the honor to be, very respectfully, your obedient servant,

CARL F. PALFREY,
Captain of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

REPORT OF COLONEL GEORGE H. MENDELL, CORPS OF ENGINEERS.

UNITED STATES ENGINEER OFFICE,
San Francisco, Cal., June 14, 1887.

SIR: I have to report in regard to works under my charge, that no piers, breakwater, or other structures built by the United States in aid of commerce or navigation are used, occupied, or injured by a corporation or by an individual, except that near the in-shore ends of both jetties of Oakland Harbor, California, a little injury has been done by fishermen in removing the top of the stone work so as to enable them to pass small fishing-boats, and save the distance required to pass around the outer ends of the jetties.

Very respectfully, your obedient servant,

G. H. MENDELL,
Colonel, Corps of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

APPENDIX Y Y.

MAINTENANCE AND REPAIRS OF WASHINGTON AQUEDUCT—INCREASING WATER SUPPLY OF THE CITY OF WASHINGTON—ERECTION OF FISH-WAYS AT THE GREAT FALLS OF THE POTOMAC.

REPORT OF MAJOR G. J. LYDECKER, CORPS OF ENGINEERS, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1888, *WITH OTHER DOCUMENTS RELATING TO THE WORKS.*

IMPROVEMENTS.

1. Washington Aqueduct.
2. Increasing the water supply of the city of Washington, District of Columbia.
3. Erection of fish-ways at the Great Falls of the Potomac.

OFFICE OF THE WASHINGTON AQUEDUCT,
Washington, D. C., July 10, 1888.

SIR: I have the honor to transmit herewith reports of operations on the Washington Aqueduct; increasing the water supply of Washington, D. C., and erection of fish-ways at Great Falls of the Potomac, for the fiscal year ending June 30, 1888.

Very respectfully, your obedient servant,

G. J. LYDECKER,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

Y Y 1.

WASHINGTON AQUEDUCT.

Operations on this work are, in general, of a routine character, and have for their object the maintenance and repairs of the aqueduct and its accessory structures, the care and repairs of the Government mains by which the water supply is taken from the distributing reservoir to the system of distributing mains of Washington and Georgetown, and the care of the high service reservoir in Georgetown. To this end the gates by which the supply of water to and through the aqueduct is regulated, at the several influent and effluent gate-houses, were regularly worked and oiled, and also the various stops on the Government main; surface drains and culverts along the line of the aqueduct road were kept clear and free from obstructions; the fencing about Government property at the Great Falls, the two reservoirs, and aqueduct office were repaired and white-washed; at the receiving reservoir some repairs were made to the keeper's dwelling, including the renewal of cornice, gutter, and down spouts. At the distributing reservoir the screens of the effluent gate-house, having been destroyed by ice, were renewed, and the domes of both gate-houses were repaired and painted. For the protection of the old dam across the Maryland Channel at the Great Falls about 850 cubic yards of riprap stone was placed as a backing.

The security of the aqueduct requires that considerable work be done annually to the overlying roadway in order to prevent heavily laden vehicles from cutting through and injuring the arch of the conduit; to this end all ruts and holes are filled with broken stone as they develop, and a macadam roadway is being gradually completed throughout the entire extent of road which overlies the conduit—the length of road so treated during the past year was about 16,700 linear feet, principally on the Great Falls division; the amount of broken stone used for that purpose being 4,682 cubic yards. The flooring of bridge spanning the waste channel at the receiving reservoir was renewed with 3-inch Georgia pine.

During the year three leaks appeared on the line of the Government mains, and were duly repaired, two of them being small affairs only, but the third a serious matter, as follows: 1st, in August, 1887, in the roadway a short distance west of the Aqueduct Bridge over the Potomac, near Georgetown, which was found to result from an abandoned service-pipe that had been tapped into the 30-inch main; it was taken out and the main securely plugged. 2d, in November, 1887, at the College Pond crossing, the calking having been blown out of a joint in the 30-inch main. 3d, about 3 o'clock on the morning of June 29, 1888, a serious break appeared at the pipe-line crossing of Foundry Branch, the repairs of which required uninterrupted work through thirty consecutive hours, during which the supply of water in the city was reduced to a dangerously low limit; one entire section of the 36-inch main, 12½ feet long, was destroyed by this break and had to be removed; another section in the immediate vicinity was found cracked, but this section was easily and quickly repaired by banding. The speedy repairs made on this occasion were rendered possible only by reason of measures that had been taken in advance, to have on hand spare joints, collars, bands, plates, etc., fitted to the size of the main, in readiness for instant application. The break appears to have been caused by the fact that this large main was at this point supported on timber sills which had rotted out and left the main, with its load of water, without proper support.

The outflow of water from the distributing reservoir, as measured during the twenty-four hours ending at 6 a. m. June 23, 1888, was 29,115,774 gallons, being 2,237,350 gallons more than the outflow as measured about the same time in the year preceding. (See Table 1.)

The water supply, as it passed the effluent gate-house of the distributing reservoir, was clear on 240 days, slightly turbid 16, turbid 52, and very turbid 58. (See Tables 2 and 3.)

The water-level at the inlet to the aqueduct at the Great Falls has varied from a maximum of 2.5 feet (on February 26, 1888) to a minimum of 0.6 feet (on August 10, 1887) above the crest of the dam. (See Table 2.)

The average water pressure for the year in the supply-mains at the crossing of Rock Creek, as reported daily at 9 a. m., was 29.93 pounds per square inch; the maximum 9 a. m. pressure was 34½ pounds, and the minimum was (disregarding the exceptional and temporary reduction caused by the breaking of the 36-inch main) 28 pounds. The average pressure during 1887 was 31.03 pounds. (See Tables 2 and 4.)

The following tables, from which the items above noted were deduced, will furnish more detailed information in relation to the same points:

TABLE 1.—*Showing hourly flow from distributing reservoir for the twenty-four hours ending June* 23, 1888.

Date.	Fall.	Consumption per hour.	Date.	Fall.	Consumption per hour.
June 22—	*Feet.*	*Gallons.*	June 22—Continued—	*Feet.*	*Gallons.*
From 6 a. m. to 7 a. m	.07	988, 384	From 8 p. m. to 9 p. m	.09	1, 256, 709
From 7 a. m. to 8 a. m	.09	1, 269, 906	From 9 p. m. to 10 p. m	.08	1, 116, 250
From 8 a. m. to 9 a. m	.10	1, 409, 856	From 10 p. m. to 11 p. m	.08	1, 115, 475
From 9 a. m. to 10 a. m	.09	1, 267, 834	From 11 p. m. to 12 m	.08	1, 114, 699
From 10 a. m. to 11 a. m	.09	1, 266, 852	From 12 m. to 1 a. m	.08	1, 113, 923
From 11 a. m. to 12 m	.10	1, 406, 462	June 23—		
From 12 m. to 1 p. m	.09	1, 264, 780	From 1 a. m. to 2 a. m	.07	974, 047
From 1 p. m. to 2 p. m	.09	1, 263, 798	From 2 a. m. to 3 a. m	.07	973, 458
From 2 p. m. to 3 p. m	.10	1, 403, 069	From 3 a. m. to 4 a. m	.08	1, 111, 790
From 3 p. m. to 4 p. m	.09	1, 261, 726	From 4 a. m. to 5 a. m	.09	1, 249, 837
From 4 p. m. to 5 p. m	.09	1, 260, 744	From 5 a. m. to 6 a. m	.08	1, 110, 142
From 5 p. m. to 6 p. m	.09	1, 259, 763			
From 6 p. m. to 7 p. m	.10	1, 398, 585	Total	2.08	29, 115, 774
From 7 p. m. to 8 p. m	.09	1, 257, 690			

The outflow during twenty-four hours, as measured in the latter part of June, for the past fifteen years is as follows:

Year.	Gallons.	Year.	Gallons.	Year.	Gallons.
1874	15, 554, 848	1879	25, 947, 642	1884	24, 827, 013
1875	21, 000, 000	1880	25, 740, 138	1885	25, 219, 194
1876	24, 177, 797	1881	26, 525, 991	1886	25, 542, 476
1877	23, 252, 932	1882	29, 727, 864	1887	26, 878, 424
1878	24, 885, 945	1883	24, 314, 715	1888	29, 115, 774

TABLE II.—*Showing—for each day in the year—(a) condition of water at Great Falls, receiving reservoir, and distributing reservoir; (b) heights of water over dam at Great Falls; (c) 9 a. m. pressures at Rock Creek.*

Day of month.	Condition of water.			Height of water over dam at Great Falls, feet.	Gauge-pressure at Rock Creek, pounds per square inch.	Condition of water.			Height of water over dam at Great Falls, feet.	Gauge-pressure at Rock Creek, pounds per square inch.	Condition of water.			Height of water over dam at Great Falls, feet.	Gauge-pressure at Rock Creek, pounds per square inch.
	Great Falls.	Receiving reservoir, south connection.	Distributing reservoir, affluent gate-house.			Great Falls.	Receiving reservoir, south connection.	Distributing reservoir, affluent gate-house.			Great Falls.	Receiving reservoir, south connection.	Distributing reservoir, affluent gate-house.		
	July, 1887.					August, 1887.					September, 1887.				
1....	36	36	36	.90	29.5	3	30	11	1.00	30.5	36	36	36	.70	29.5
2....	36	36	36	.80	30.0	2	32	9	.90	30.0	36	36	36	.70	29.5
3....	36	36	36	.80	30.5	3	36	7	.90	29.0	36	36	36	.70	30.0
4....	36	36	36	.80	30.5	4	36	9	.80	29.5	36	36	36	.70	29.5
5....	36	36	36	.80	29.5	7	36	12	.80	30.0	36	36	36	.70	29.5
6....	36	36	36	.80	30.0	9	36	15	.80	29.5	36	36	36	.70	29.5
7....	36	36	36	.80	30.0	10	36	15	.70	30.0	36	36	36	.70	29.5
8....	15	36	36	.80	30.0	13	36	15	.70	29.5	36	36	36	.70	29.5
9....	17	36	36	.80	30.0	24	36	19	.70	29.0	36	36	36	.70	29.5
10....	7	36	36	.90	30.5	24	36	23	.60	29.0	36	36	36	.70	29.5
11....	27	36	36	.80	30.0	30	36	36	.70	29.0	36	36	36	.70	30.0
12....	28	36	36	.80	29.5	12	36	36	.80	29.5	36	36	36	.70	29.0
13....	33	36	36	.80	30.0	10	36	36	.80	30.0	26	36	36	.70	29.5
14....	36	36	36	.80	29.0	23	36	36	.80	30.0	29	36	36	.80	29.5
15....	36	36	36	.70	30.0	25	36	36	.70	29.5	14	36	36	.90	30.0
16....	36	36	36	.70	29.5	26	36	36	.70	29.0	36	36	36	.90	29.5
17....	36	36	36	.70	30.0	24	36	36	.70	30.0	31	26	36	.80	*34.5
18....	36	36	36	.70	29.5	26	36	36	.80	29.5	31	36	36	.90	32.5
19....	23	36	36	.70	29.5	26	36	36	.80	30.0	36	36	36	.80	30.0
20....	33	36	36	.70	30.0	36	36	36	.70	30.0	36	36	36	.80	*34.0
21....	36	36	36	.70	29.5	36	36	36	.70	30.0	36	36	36	.80	30.0
22....	36	36	36	.80	29.5	36	36	36	.70	29.5	36	36	36	.70	30.5
23....	36	36	36	.80	30.0	36	36	36	.70	30.0	36	36	36	.80	30.5
24....	3	36	36	1.30	30.0	27	36	36	.80	29.5	36	36	36	.80	30.0
25....	2	36	36	1.00	29.5	36	36	36	.80	29.5	36	36	36	.80	31.0
26....	2	36	36	1.00	30.0	34	36	36	.80	29.5	36	36	36	.80	34.0
27....	1	36	34	1.70	30.0	14	36	36	.80	29.5	36	36	36	.80	34.0
28....	1	36	22	1.50	29.5	12	36	36	.80	31.0	36	36	36	.70	31.0
29....	1	36	20	1.40	30.0	13	36	36	.80	28.0	36	36	36	.80	30.5
30....	2	36	16	1.20	29.5	24	28	36	.80	29.0	34	36	36	.80	31.0
31....	3	36	15	1.00	31.0	36	26	36	.80	29.0	.....	......	......	......	......
	October, 1887.					November, 1887.					December, 1887.				
1....	36	36	36	.80	30.0	36	36	36	.70	30.5	36	36	36	.70	30.0
2....	36	36	36	.80	30.5	36	36	36	.70	30.0	36	36	36	.70	29.5
3....	36	36	36	.80	30.0	36	36	36	.70	30.5	36	36	36	.70	[illegible]
4....	36	36	36	.80	29.5	36	36	36	.70	31.0	36	36	36	.70	[illegible]
5....	36	36	36	.80	30.0	36	36	36	.70	30.5	36	36	36	.70	[illegible]
6....	36	36	36	.80	30.0	36	36	36	.70	31.5	36	36	36	.70	[illegible]
7....	36	36	36	.80	30.0	36	36	36	.70	30.0	36	36	36	.70	[illegible]
8....	36	36	36	.80	30.0	36	36	36	.70	30.5	36	36	36	.70	[illegible]
9....	36	36	36	.80	30.5	36	36	36	.70	30.5	36	36	36	.70	[illegible]
10....	36	36	36	.70	29.5	36	36	36	.70	30.5	36	36	36	.70	[illegible]
11....	36	36	36	.70	30.0	36	36	36	.70	31.0	36	36	36	.80	[illegible]
12....	36	36	36	.70	29.5	36	36	36	.70	31.0	20	36	36	1.00	[illegible]
13....	36	36	36	.70	30.0	36	36	36	.70	31.0	15	36	36	1.00	[illegible]
14....	36	36	36	.70	30.0	36	36	36	.70	31.0	4	36	36	1.00	[illegible]
15....	36	36	36	.70	30.0	36	36	36	.70	30.5	4	36	36	1.00	[illegible]
16....	36	36	36	.70	31.5	36	36	36	.70	30.5	3	30	30	1.10	[illegible]
17....	36	36	36	.70	2.95	36	36	36	.70	30.5	3	20	26	1.10	[illegible]
18....	36	36	36	.70	29.0	36	36	36	.70	30.5	3	20	22	1.20	[illegible]
19....	36	36	36	.70	30.0	36	36	36	.70	30.5	2	16	20	1.10	[illegible]
20....	36	36	36	.70	30.5	36	36	36	.70	30.5	4	20	10	1.00	[illegible]
21....	36	36	36	.70	30.0	36	36	36	.70	30.5	2	16	10	1.10	[illegible]
22....	36	36	36	.70	30.0	36	36	36	.70	30.5	2	14	8	1.10	[illegible]
23....	36	36	36	.70	31.0	36	36	36	.70	30.5	3	13	8	1.20	[illegible]
24....	36	36	36	.70	30.0	36	36	36	.70	31.0	3	14	9	1.10	[illegible]
25....	36	36	36	.70	30.0	36	36	36	.70	31.0	3	12	10	1.10	[illegible]
26....	36	36	36	.70	30.0	36	36	36	.70	30.5	4	9	11	1.10	[illegible]
27....	36	36	36	.70	29.0	36	36	36	.70	31 0	4	10	11	1.10	[illegible]
28....	36	36	36	.70	30.5	36	36	36	.70	30.5	4	10	13	1.10	[illegible]
29....	36	36	36	.70	30.0	36	36	36	.70	30.5	4	12	13	.80	[illegible]
30....	36	36	36	.70	31.0	36	36	36	.70	30.0	4	12	13	.80	[illegible]
31....	36	36	36	.70	30.5	.....	......	......	......	......	4	12	12	.80	[illegible]

* Break in 36-inch main.

TABLE II.—*Showing—for each day in the year—(a) condition of water at Great Falls, receiving reservoir, and distributing reservoir; (b) height of water over dam at Great Falls; (c) 9 a. m. pressure at Rock Creek.*

Day of month.	Condition of water.			Height of water over dam at Great Falls, feet.	Gauge pressure at Rock Creek, pounds per square inch.	Condition of water.			Height of water over dam at Great Falls, feet.	Gauge pressure at Rock Creek, pounds per square inch.	Condition of water.			Height of water over dam at Great Falls, feet.	Gauge pressure at Rock Creek, pounds per square inch.
	Great Falls.	Receiving reservoir, south connection.	Distributing reservoir, affluent gate-house.			Great Falls.	Receiving reservoir, south connection.	Distributing reservoir, affluent gate-house.			Great Falls.	Receiving reservoir, south connection.	Distributing reservoir, affluent gate-house.		
	January, 1888.					February, 1888.					March, 1888.				
1....	2	13	15	1.00	29.5	36	36	36	.90	29.5	2	4	6	1.50	30.0
2....	2	10	14	1.20	30.0	36	36	36	.90	29.5	6	6	6	1.50	30.0
3....	3	12	12	1.30	29.5	36	30	36	1.00	29.5	6	9	6	1.40	30.0
4....	3	13	12	1.40	30.0	36	36	36	1.00	29.5	6	10	5	1.40	30.5
5....	4	11	9	1.40	30.0	4	36	36	1.00	31.0	6	7	6	1.40	30.0
6....	4	9	9	1.20	30.0	4	30	36	1.20	29.5	6	6	7	1.40	30.0
7....	4	8	9	1.00	30.0	2	11	36	1.30	29.5	7	8	8	1.30	30.0
8....	4	9	8	1.20	30.5	2	8	36	1.30	30.0	7	9	8	1.20	30.0
9....	1	11	7	2.00	30.0	2	8	36	1.50	29.5	7	10	8	1.20	30.0
10....	1	15	7	2.00	30.0	2	6	21	1.60	29.0	9	11	7	1.20	30.0
11....	1	16	7	1.90	30.0	2	5	12	1.60	29.0	8	12	7	1.10	30.5
12....	2	12	7	1.70	29.0	6	6	8	1.30	29.5	2	6	6	2.00	30.0
13....	3	10	10	1.40	29.5	8	8	5	1.30	29.5	1	5	4	2.00	29.0
14....	5	10	11	1.30	29.5	8	11	5	1.30	29.0	1	3	4	1.80	29.5
15....	5	10	12	1.20	30.0	6	12	6	1.40	29.5	1	3	3	1.60	30.0
16....	5	13	8	1.30	29.5	6	13	8	1.60	29.0	1	4	3	1.50	30.0
17....	5	15	8	1.40	29.5	6	14	8	1.40	29.0	2	4	3	1.30	30.5
18....	7	15	9	1.30	30.0	3	15	10	1.70	29.5	2	4	3	1.50	31.5
19....	10	16	9	1.20	29.0	3	15	11	1.80	30.0	2	5	3	1.60	30.0
20....	20	16	10	1.10	29.5	3	6	12	2.00	29.0	3	5	3	1.60	31.0
21....	17	22	10	1.00	29.0	1	6	7	2.00	29.5	3	4	4	1.60	30.5
22....	19	22	17	1.00	29.5	1	5	8	2.40	29.5	1	4	4	2.00	31.0
23....	22	24	18	1.00	28.5	1	7	8	2.20	30.0	1	5	3	2.30	30.5
24....	22	30	18	1.00	29.0	2	8	9	2.00	30.0	1	4	4	2.20	30.5
25....	28	32	20	1.00	29.5	2	6	9	1.90	30.0	1	4	4	2.10	31.5
26....	26	32	26	.90	29.0	1	5	6	2.50	30.5	3	4	4	1.80	30.5
27....	26	33	20	.70	29.0	1	5	6	2.40	30.0	2	4	4	1.70	31.0
28....	20	36	36	.70	28.5	1	5	5	2.10	29.5	3	4	4	1.70	31.0
29....	32	36	36	.70	29.0	1	4	5	1.80	29.5	1	5	4	1.90	31.0
30....	36	36	36	.80	29.0	....	......	......	......	....	1	6	3	2.30	31.5
31....	36	36	36	.80	29.0	....	......	......	......	....	2	3	4	2.30	32.0
	April, 1888.					May, 1888.					June, 1888.				
1....	2	7	4	2.00	31.5	36	36	36	.90	29.5	3	36	36	1.60	28.5
2....	8	8	4	1.90	31.0	36	36	36	.90	30.0	7	35	36	1.80	29.0
3....	3	9	4	1.70	31.0	36	36	36	.90	29.5	4	34	36	1.80	29.5
4....	4	10	4	1.60	30.5	36	36	36	.90	29.5	4	35	36	1.60	28.5
5....	7	10	4	1.50	31.0	36	36	36	.90	30.0	12	36	36	1.40	29.0
6....	10	12	4	1.40	31.0	36	36	36	.90	30.0	19	36	36	1.30	29.0
7....	2	13	4	1.50	30.5	36	36	36	.90	29.5	20	36	36	1.20	29.0
8....	14	14	5	1.60	31.5	36	36	36	.80	29.5	21	36	36	1.10	28.5
9....	12	12	5	1.70	31.0	36	36	36	.80	29.5	24	36	36	1.00	29.0
10....	3	12	5	1.50	31.0	36	36	36	.80	29.5	29	36	36	1.00	29.5
11....	8	12	5	1.60	30.5	36	36	36	.90	30.0	20	36	36	1.00	28.5
12....	1	13	6	1.80	30.0	30	36	36	1.20	31.0	32	36	36	.90	29.0
13....	2	13	6	1.80	30.0	32	36	36	1.20	31.0	34	36	36	.90	29.0
14....	2	12	6	1.70	30.0	5	36	36	1.20	30.0	36	36	36	.90	28.5
15....	4	10	7	1.50	32.0	19	36	36	1.30	29.0	3	36	36	1.00	29.0
16....	8	10	7	1.40	30.0	8	36	36	1.30	29.0	6	36	36	.90	28.5
17....	13	9	7	1.30	30.0	6	36	36	1.20	29.0	6	36	36	.80	30.0
18....	20	11	8	1.10	30.0	13	36	36	1.10	30.0	12	36	36	.80	29.0
19....	22	14	8	1.20	30.0	17	36	36	1.10	29.5	31	36	36	.80	29.0
20....	25	14	9	1.20	30.0	18	36	36	1.10	30.5	36	36	36	.70	29.5
21....	16	15	9	1.10	30.0	26	36	36	1.10	30.0	36	36	36	.60	28.5
22....	24	13	11	1.10	31.0	31	36	36	1.10	30.0	36	36	36	.60	28.5
23....	27	16	13	1.10	30.0	32	36	36	1.10	29.5	36	36	36	.60	28.0
24....	30	18	20	1.10	30.0	30	36	36	1.10	29.5	36	36	36	.60	28.5
25....	32	17	25	1.10	30.0	26	36	36	1.20	30.0	36	36	36	.60	28.0
26....	36	17	30	1.00	30.0	12	36	36	1.40	30.0	3	36	36	.60	28.5
27....	36	17	36	1.10	30.0	6	36	36	1.70	30.5	3	36	36	.70	28.5
28....	36	25	36	1.00	29.5	6	36	36	1.70	29.5	13	36	36	.70	29.0
29....	36	30	36	.90	30.5	8	36	36	1.70	29.0	6	36	36	.80	*18.5
30....	36	36	36	.90	29.5	2	36	36	1.60	29.5	6	36	36	.80	*20.0
31....	....	......	......	......	....	7	36	36	1.50	29.5	....	......	......	......	....

*Break in 36-inch main.

TABLE 3.—(*Compiled from Table 2*) *showing number of days during which the water*
clear or turbid at the places indicated.

Place.	Clear.	Slightly turbid.	Turbid.	Very turbid.
Great Falls	194	15	26	[illegible]
Receiving reservoir	250	19	60	[illegible]
Distributing reservoir	210	16	52	[illegible]

TABLE 4.—(*Compiled from Table 2*) *showing number of days in each month in wh*
9 a. m. (*pound*) *pressures were.*

Month.	Twenty-eight.	Twenty-eight and a half.	Twenty-nine.	Twenty-nine and a half.	Thirty.	Thirty and a half.	Thirty-one.	Thirty-one and a half.	Thirty-two.	Thirty-three and a half.	Thirty-four.	Thirty-four and a half.	Average pressure.
1887.													
July	......	......	1	11	15	3	1	......	......	......	......	......	[illegible]
August	1	......	7	11	15	......	1	......	......	......	......	......	[illegible]
September	......	......	......	11	8	5	3	......	......	1	1	1	[illegible]
October	......	......	2	4	17	5	2	1	......	......	......	......	[illegible]
November	......	......	......	......	3	17	8	2	......	......	......	......	[illegible]
December	......	1	2	1	15	10	2	......	......	......	......	......	[illegible]
1888.													
January	......	2	9	9	10	1	......	......	......	......	......	......	[illegible]
February	......	......	6	15	6	1	1	......	......	......	......	......	[illegible]
March	......	......	1	1	13	7	5	3	1	......	......	......	[illegible]
April	......	......	......	2	14	4	7	2	1	......	......	......	[illegible]
May	......	......	4	13	10	2	2	......	......	......	......	......	[illegible]
June*	2	11	11	3	1	......	......	......	......	......	......	......	[illegible]
Total	8	14	43	81	123	55	32	8	2	1	1	1	[illegible]

* June 29, 18.5 pounds; June 30, 20 pounds; occasioned by break in 36-inch main.

List of appropriations made for the Washington Aqueduct, with the date of act for the sa

Date.	Amount.	Date.	Amount.
September 30, 1850	$500	March 3, 1873[3]	[illegible]
August 31, 1852[1]	5,000	June 23, 1874[4]	[illegible]
March 3, 1853	100,000	March 3, 1875	[illegible]
March 3, 1855	250,000	July 31, 1876	[illegible]
August 18, 1856	250,000	March 3, 1877	[illegible]
March 3, 1857	1,000,000	June 20, 1878	[illegible]
June 12, 1858	800,000	March 3, 1879[5]	[illegible]
June 25, 1860	500,000	June 4, 1880[6]	[illegible]
July 4, 1864	150,000	March 3, 1881	[illegible]
July 28, 1866	142,584	July 1, 1882[7]	[illegible]
December 20, 1866	12,000	March 3, 1883	[illegible]
March 2, 1867	20,000	July 5, 1884	[illegible]
July 25, 1868	52,500	February 25, 1885	[illegible]
March 3, 1869	25,000	July 9, 1886	[illegible]
July 15, 1870[2]	120,822	March 3, 1887	[illegible]
March 3, 1871	114,196		
June 10, 1872	70,555	Total	[illegible]
January 23, 1873	14,000		

NOTE.—Reverted to the Treasury: [1]$2.81, [2]$46.25, [3]$560.87, [4]35 cents, [5]$1,109.87, [6]$381.06, [7]$1,354. total, $3,455.38. The balance, $3,961,701.62, being the amount expended to June 30, 1888. Since 18 one-half of the amounts appropriated have been contributed by the United States and the other h by the District of Columbia.

The money statement for the year ending June 30, 1888, is as follow

July 1, 1887, amount available		$20,00
July 1, 1888, amount expended during fiscal year	19,021.94	
July 1, 1888, outstanding liabilities	978.06	
		20,00

The amount required for engineering, maintenance and repairs of the Washington Aqueduct, and its appurtenances, for the year ending June 0, 1890, is $20,000, which sum, as shown by long experience, is that re-uired for the aforesaid purposes.

Y Y 2.

NCREASING THE WATER SUPPLY OF THE CITY OF WASHINGTON, DISTRICT OF COLUMBIA.

This work was commenced pursuant to an act of Congress approved uly 15, 1882, and includes as its salient features (1) raising the dam n the Maryland channel at the Great Falls of the Potomac, to an levation of 148 feet above mean high tide at the Washington Navy-Yard, and its extension at that height across Conn's Island and the Virginia channel of the river; (2) extending the Washington Aqueduct rom the distributing reservoir, near Drover's Rest, to the site selected or the new reservoir, near Howard University; the plan adopted for his extension being a tunnel under pressure 20,696.3 feet long; (3) constructing at the tunnel outlet a reservoir of about 300,000,000 gallons capacity; (4) connecting the new reservoir with the existing system of water-mains in the city of Washington by a new line of large mains.

Operations during the past fiscal year have been chiefly on the tunnel and reservoir, the dam having been finished in August, 1886, and the new mains laid up to the site of the reservoir in 1885.

The following is an outline of the history of operations during the year, and further details are given in the report of Lieut. C. McD. Townsend, Corps of Engineers, submitted herewith:

DAM AT THE GREAT FALLS.

Operations on this portion of the work were completed, as before stated, during the fiscal year ending June 30, 1887, but the urgent deficiency bill passed by Congress early in the present session, and approved February 1, 1888, contained the following item of appropriation:

> To enable the Secretary of War to pay to Chittenden Brothers, contractors, for money expended in the construction of a dam at the Great Falls of the Potomac, over and above that contemplated in the contract with said Chittenden Brothers, as amended, the sum of $15,000, payable from any unexpended balance of money appropriated for the construction of such dam.

In accordance with the foregoing, payment was duly made to the said Chittenden Bros. on the 11th of February, 1888. This was the only expenditure made on account of the appropriation for the dam during the past fiscal year, leaving on hand June 30, 1888, a balance of $4,665.52.

The total amount appropriated for this part of the work was $145,151, and the expenditures therefrom have been as follows:

Paid to contractors for contract work, as per detailed statement in my last annual report	$114,509.02
Paid to contractors, pursuant to special appropriation of February 1, 1888	15,000.00
Total paid to contractors	129,509.02
Expenses of surveys, engineering, superintendence, etc	10,976.46
Balance available	4,665.52
Total appropriation	145,151.00

TUNNEL FOR AQUEDUCT EXTENSION.

At the beginning of the fiscal year the tunnel had been "holed through, 6,110 feet had been lined, and operations were in progres under Beckwith & Quackenbush, contractors.

Work under this contract was continued until September 30, 1887 but with a light force, on account of the small balance of money remaining on hand, and operations were limited to trimming and enlarging the tunnel to the necessary lining section, and to placing the masonry lining in parts where the worst character of rock was found Finally, the money having become about exhausted, all work of construction was suspended on the 30th of September, 1887, and the contractors were directed to clear the tunnel of all refuse and débris, i order to permit a final measurement of the work done by them up t the date of suspension. This having been accomplished, settlement was made with the contractors, including a payment of $78,279.51 o the amount that had, up to that time, been withheld as a retained percentage. This was done pursuant to supplemental articles of agreement dated December 5, 1887, which also provided for the care of the tunnel during the period of suspension of work, and for the preliminary work of pumping the tunnel clear of water, as soon as a new appropriation by Congress should make a resumption of active operations possible. These articles were as follows:

Supplemental articles of agreement entered into this 5th day of December, eighteen hundred and eighty-seven (1887), between Major G. J. Lydecker, Corps of Engineers, U. S. Army, of the first part, and Clinton Beckwith and John V. Quackenbush, partners, doing business under the firm name of Beckwith and Quackenbush, of Mohawk, of the county of Herkimer, State of New York, of the second part these articles, now herein named, being in furtherance of and supplementary t certain articles of agreement entered into by the parties aforesaid, relating to the construction of a tunnel for increasing the water supply of Washington, D. C., o the 29th day of October, 1883, and to certain supplemental articles of agreement concerning the same, and between the same parties, entered into on the 18th day o October, 1886.

Whereas by reason of the exhaustion of appropriations heretofore made for the conduct of the work in question, it has become necessary to suspend active operations thereon under the original and supplemental articles hereinbefore referred to, and t the advantage of both parties therein concerned to make provisions for the protection of their mutual interests during the period of such suspension, which must endure until a further appropriation by the Congress of the U. S. makes a resumption of the work possible: Therefore,

This agreement witnesseth, that the said Major G. J. Lydecker, Corps of Engineers for and in behalf of the United States of America, and the said Beckwith & Quackenbush, for themselves, their heirs, executors, and administrators, have mutually agreed and by these presents do mutually covenant and agree, to and with each other as follows:

First. That, in consideration of the work already done to the satisfaction of the party of the first part, and of the further consideration that the entire work in contemplation can not be completed under any contract in which the parties of the second part are now concerned, the party of the first part shall surrender and pay to the parties of the second part the sum of seventy-eight thousand two hundred and seventy-nine dollars and fifty-one cents ($78,279.51) such sum being eighty-five (85) per cent. of the percentage heretofore retained and withheld from the parties of the second part, a a guarantee for the faithful performance of their work as provided in the original articles of agreement.

Second. That the parties of the second part may defer the removal of machinery, rubbish, and refuse material from the site of the work as provided in the original specifications relating thereto, until required to do so by the party of the first part, after an appropriation for the resumption of operations shall have been made by Congress; and when such removal shall have been effected to the satisfaction of the party of the first part, final payment of all sums justly due to the parties of the second part will be completed, but if such removal shall not have been effected within thirty (30) days after being ordered the balance of all retained percentages or other moneys due the parties of the second part shall be forfeited to the United States; provided the order for such removal shall not be given within five (5) days after the award of a new contract for continuing work on the tunnel. And provided further, that no such order of removal will be given at that time. (1st) If the parties of the second part remain as contractors on the work, to complete it, or (2nd) if within the five (5) days aforesaid, they arrange with their successors on the work for the transfer to such successors of all responsibility in relation to such removal, in a manner and under conditions satisfactory in all respects to the party of the first part; whereupon, in either of these two cases, final settlement on account of contracts now existing will be made in such manner as may then to be found just and proper.

Third. That the pumping machinery at Foundry Branch and Rock Creek shafts shall be kept in proper working order for service at all times by the parties of the second part, so that it may be at any time put into active operation on the orders of the party of the first part; and to that end there shall be in daily service on the work one competent engineer (who shall also be a machinist), whose duty it shall be to care for such pumping machinery, and who shall receive as compensation for such service from the party of the first part the sum of sixty dollars ($60.00) for each calendar month, to date from the day on which these articles of agreement may go into effect, as hereinafter provided.

Fourth. That the party of the first part shall, at his option, put into active service the pumping machinery at both or either of the two shafts named in the foregoing paragraph at any time during the suspension of work hereinbefore referred to, paying to the parties of the second part the sum of three dollars ($3.00) for each day of twenty-four (24) hours that each set of pumping machinery shall be in active use. It being understood that the party of the first part shall control and pay for all necessary operating expenses in connection with such active pumping operations.

It is understood and agreed that nothing herein contained shall be construed to release from, or add to, any obligation, liability, right, or duty devolving on either party under the operations of the two several articles of agreement, to which the foregoing are supplemental.

It is further understood that these supplemental articles of agreement are to become operative only when approved by the Chief of Engineers and the Secretary of War, and if not so approved to be void and of no effect whatever.

In witness whereof the undersigned have hereunto placed their hands and seals the date first hereinbefore written.

G. J. LYDECKER, [SEAL.]
Major of Engineers, U. S. A.
BECKWITH & QUACKENBUSH. [SEAL.]

Witnesses:
SIMON NEWTON.
JOHN M. LASKEY.

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
December 15, 1887.

Approved.

CHAS. W. RAYMOND,
Acting Chief of Engineers.

[Second indorsement.]

WAR DEPARTMENT,
December 19, 1887.

Approved.

R. MACFEELY,
Acting Secretary of War.

After the suspension of work the tunnel was allowed to fill with water, thereby avoiding the expense of pumping operations and providing a moderate test of the strength of lining already constructed in resisting the outward pressure of water.

The act of Congress—general deficiency—approved March 30, 1888, included the following item of appropriation:

To enable the Secretary of War to complete the work of increasing the water supply of the city of Washington, under the act entitled "An act to increase the water supply of the city of Washington, and for other purposes," approved July fifteenth, eighteen hundred and eighty-two, namely: For completion of lining of the tunnel, two hundred and ninety-seven thousand seven hundred and fifty dollars; for completing shafts, west connection, and for superintendence and engineering, thirty-seven thousand two hundred and fifty dollars; and for general contingencies of the work, twenty thousand dollars; in all, three hundred and fifty-five thousand dollars; all of said work to be completed by November first, eighteen hundred and eighty-eight; said sum to be subject to all the provisions and restrictions of the said act of July fifteenth, eighteen hundred and eighty-two, and of the act approved July fifth, eighteen hundred and eighty-four, making appropriations for the expenses of the government of the District of Columbia, as to its apportionment and settlement between the United States and the District of Columbia, and the refunding thereof. The work above provided for to be done under the contract heretofore made, or by a reletting, as in the discretion of the Secretary of War shall be most promotive of the interest of the Government: *Provided*, That no contract shall be made at prices greater than the prices allowed under contract under which work has been heretofore done on said tunnel.

Immediately on the passage of this act the necessary measures for resuming operations at the earliest day possible were inaugurated. To this end the work of pumping out the tunnel was commenced at once, under the supplemental articles of agreement hereinbefore quoted, and additional articles were entered into with the same contractors, for completing the work of lining. One of the most urgent reasons, if not indeed the controlling one, for continuing the same contractors on the work, was a proviso in the act of appropriation, which required the completion of the work by November 1, 1888. It was clearly impossible to comply with this requirement, but quite evident that the nearest approach thereto would be by avoiding the long delay that would necessarily follow advertisement for new bids, a reletting of the work, and the establishment thereon of new contractors and a new working plant.

These articles of agreement are as follows:

Supplemental articles of agreement entered this 8th day of May, eighteen hundred and eighty-eight (1888), between Major G. J. Lydecker, Corps of Engineers, U. S. Army, of the first part, and Clinton Beckwith and John V. Quackenbush, partners, doing business under the firm name of Beckwith & Quackenbush, of Mohawk, of the county of Herkimer, State of New York, of the second part; these articles, now herein named, being in furtherance of and supplementary to certain articles of agreement entered into by the parties aforesaid, relating to the construction of a tunnel for increasing the water supply of Washington, D. C., on the 29th day of October, 1883, and to certain supplemental articles of agreement concerning the same, and between the same parties, entered into on the 18th day of October, 1886, and on the 5th day of December, 1887.

Whereas the urgent deficiency act of Congress approved March 30th, 1888, appropriates the sum of $355,000 for completing the Washington Aqueduct Tunnel, heretofore in process of construction under the contract and supplemental articles of agreement above named; and whereas said act provides: 1st. That all the work shall be completed by November 1st, 1888; 2d. That it may be done under the contract heretofore made or by a reletting, as in the discretion of the Secretary of War shall be most promotive of the interest of the Government; and, 3d. That no contract shall be made at prices greater than the prices allowed under contract under which work has been heretofore done at the tunnel. And whereas the Secretary of War has determined that it will be most promotive of the interest of the United States to complete the said tunnel work under the contract and articles supplemental thereto hereinbefore referred to; provided the parties thereto subscribe to the conditions hereinafter named: Therefore,

This agreement witnesseth that the said Major G. J. Lydecker, Corps of Engineers, for and in behalf of the United States of America, and the said Beckwith & Quackenbush, for themselves, their heirs, executors, and administrators, have mutually agreed, and by these presents do mutually covenant and agree, to and with each other as follows:

First.—That the parties of the second part shall continue to completion, so far as the money already appropriated shall suffice, the work on the tunnel aforesaid. It being expressly understood that the parties of the second part will use all means in their power to complete the work by the 1st day of November, 1888, and that all instructions from the party of the first part, concerning the steps to be taken to secure completion on said date, shall be promptly obeyed and rigidly adhered to. It is understood that the tunnel lining to be done under these supplemental articles of agreement will include three classes, viz: 1st. Brick arch, side-wall, and invert, such as has heretofore been applied to the work, substantially as shown on tracing hereto attached, in section marked "A." 2d. Rubble masonry side-walls, and two-ring brick arch, substantially as shown on tracing hereto attached, in section marked "B." 3d. Rubble masonry side-walls, and three-ring brick arch, substantially as shown on tracing hereto attached, in section marked "C." The backing in all cases to be of rubble masonry such as called for in previous article of agreement. The rubble masonry side-walls contemplated herein will be not less than eighteen (18) inches in thickness, and constructed throughout in accordance with the following:

Specifications for rubble side-walls.—The rubble side-walls provided for in these articles will be constructed of clean, sound, and durable stone, selected for the purpose. They must be carefully laid in cement mortar, in such manner as to fit approximately, being roughly-shaped with the hammer if necessary to make such fit. Mortar must be freely used, so as to solidly fill all spaces between stones and to bulge out beyond the face joints when the stone is placed in position, the object being to make the wall as nearly water-tight as possible. The face of the wall must be laid true to the lines given, and so that projections shall not extend more than one and one-half (1½) inches beyond the designated plane of the face. The facing joints shall be neatly outlined and finished, and the top of the wall shall be truly leveled to the spring of the brick arch.

It is further agreed that payment for the aforesaid work of lining shall be as follows: For full lining of 1st class, forty dollars ($40) per linear foot of tunnel so lined; for lining of 2d class, twenty-four dollars and fifty cents ($24.50) per linear foot of tunnel so lined; for lining of 3d class, twenty-eight dollars and fifty cents ($28.50) per linear foot of tunnel so lined. The prices aforesaid being no greater than those allowed under the contract under which work has heretofore been done on the tunnel, and such as will insure the completion of the work within the limits of the sum appropriated therefor. It is expressly understood that the prices paid as above include compensation for all work and material necessary for the solid lining of the tunnel in the several classes, as well as the work of enlarging the tunnel from the normal cross-section to that required for placing the designated lining.

It is further stipulated and agreed that all brick-work in the lining of the tunnel shall be done by expert brick masons, and that the stone-work of said lining shall be done by expert stone masons.

In consideration of the first proviso of the urgent deficiency act hereinbefore named, it is also understood and agreed that if work on the tunnel is not completed by the 1st day of November, 1888, the parties of the second part may, at their option, continue to prosecute the work within the limits provided for by the appropriation of $355,000 made by Congress in the act herein named, but no payment for such work done, or material furnished, after said date, shall be made until Congress shall have extended the time for the completion of the work, unless the Secretary of War shall then determine that the time for completion under these articles of agreement may be extended, and shall thereupon expressly authorize payment to be made, in the usual manner, for the work done during the period of extension.

It is further understood and agreed that nothing herein contained shall be construed to release from, or add to, any obligation, liability, right, or duty, involved in the original contract of October 29th, 1883, or any article of agreement supplemental thereto, so far as concerns the parties in interest, except as specifically provided in these final supplemental articles now signed and dated this 8th day of May, 1888, which said final articles are to become operative only when approved by the Chief of Engineers, U. S. Army, and the Secretary of War.

In witness whereof the undersigned have hereunto placed their hands and seals the date first hereinbefore written.

G. J. LYDECKER, [SEAL.]
Major of Engineers, U. S. A.
BECKWITH & QUACKENBUSH. [SEAL.]

Witnesses:
SIMON NEWTON,
JOHN M. LASKEY.

Approved May 9, 1888.

J. C. DUANE,
Brig. Gen., Chief of Engineers.

[First indorsement.]

WAR DEPARTMENT, *May* 10, 1888.

Approved.

WILLIAM C. ENDICOTT,
Secretary of War.

It will be observed that the above articles provide for three classes of lining: (1) "Brick arch, side-wall, and invert, such as has heretofore been applied to the work;" this will cost $40 per linear foot, and was designed to be used in only about 325 feet of the length then remaining to be lined. (2) "Rubble side-walls, and *two*-ring brick arch," costing $24.50 per linear foot, and designed for about 11,354 feet. (3) "Rubble masonry side-walls, and *three*-ring brick arch," costing $28.50 per linear foot, and designed for a few short sections of tunnel, aggregating in length about 250 feet.

The tunnel, having been cleared of water, showed that no damage had been done by allowing it to fill; the working plant was put in order, the work of placing lining was resumed in the latter part of May, and operations to that end are now in progress in all sections of the tunnel. The total length of tunnel lined during the year was only 3,959.5 linear feet, but of this 1,186 were placed during the past month (June, 1888). The total length lined to June 30, 1888, is 10,099½ feet, and there then remained 10,626.8 feet to be lined.

The contractors have as yet by no means made such arrangements as are requiste to finish the entire work at the earliest possible date, in spite of repeated directions from this office having that object in view; especially has progress in the heading east from Foundry Branch working shaft been unsatisfactory, less lining having been placed in that section than in any other, whereas the greatest distance to be lined is in that one. It is hoped and belived, however, that the contractors will soon see the necessity of changing their course in this respect, and comply with the directions given for their guidance, and thereby avoid the stipulated penalty of persistent refusal to comply with the requirements of their contract.

The total estimate of work done by the contractors on the tunnel up to June 30, 1888, is as follows:

76,161 cubic yards excavation in tunnel, at $8	$609,288.00
2,148.75 cubic yards earth excavation in shafts, at $6	12,892.50
2,676 cubic yards rock excavation in shafts, at $10	26,760.00
10,891 cubic yards brick masonry in tunnel, at $14	152,474.00
2,339 cubic yards concrete masonry in tunnel, at $5	11,695.00
4,936.72 cubic yards dry-stone packing in tunnel, at $2.50	12,341.80
383 cubic yards brick masonry in shafts, at $18	6,894.00
600 cubic yards concrete masonry in shafts, at $5	3,000.00
930 cubic yards dry-stone packing in shafts, at $2.50	2,325.00
444 linear feet air-shafts complete, at $15	6,660.00
637.78 cubic yards extra excavation, at $1.50	956.67
15,926 cubic yards rubble masonry in tunnel, at $4.75	75,648.50
1,295 linear feet tunnel lining, second class, at $24.50	31,727.50
Total for contract work	952,662.97

Payment on account of the above has been made to contractors as follows:

On monthly estimates	$857,396.68
85 per cent. of retained percentages on work done prior to September 30, 1887	78,279.51
Balance due on contract work	16,986.78
	952,662.97

The cost of work done during the past year, included in above statement, was $124,417.70.

In addition to the above total, there have been expended for aqueduct extension the following sums:

For west connecting conduit (1886)	$5,005.58
For pumping during suspension of operations in 1886	7,035.00
For pumping under supplemental articles dated December 5, 1887	2,830.36
For engineering, superintendence, and contingencies, including cost of preliminary surveys and examinations (1882–1888)	44,339.45
	59,210.39

This, added to the total cost of work done under contract ($952,662.97), makes the grand total of expenditures up to June 30, 1888, including outstanding liabilities and retained percentages, $1,011,873.36.

The appropriations have been as follows:

Act approved July 15, 1882	$599, 534. 55
Act approved March 26, 1886 (pumping)	5, 000. 00
Act approved August 4, 1886	395, 000. 00
Act approved March 30, 1888	355, 000. 00
Total	1, 354, 534. 55

Deducting therefrom the total expenditures and liabilities for work already done to June 30, 1888, $1,011,873.36, the balance available at that date was $342,661.19, the expenditure of the greater part of which is provided for by existing contracts. As nearly as can now be determined this sum will suffice for the completion of the work, in all its essential features, wherefore no estimate for any additional appropriation is submitted at this time.

NEW RESERVOIR.

The contract with Maloney & Gleason for the completion of this part of the work expired June 30, 1887, at which time there remained about 50,000 cubic yards of excavation and 12,000 square yards of slope paving, together with a small amount of sodding, to be done, in order to complete so much of the reservoir as it was proposed to do under the contracts mentioned above. Accordingly, it was determined to make a further extension of time, and this was done subject to the condition that the contractors should forfeit to the United States the sum of $300 for each calendar month during the period of suspension, pursuant to the following supplemental articles of agreement:

Supplemental articles of agreement entered into this 20th day of July, eighteen hundred and eighty-seven (1887), between Major G. J. Lydecker, Corps of Engineers, U. S. Army, of the first part, and Patrick Maloney and Andrew Gleason, partners, doing business under the firm name of Maloney & Gleason, of Washington, of the District of Columbia, of the second part:

Whereas, on the 30th day of October, 1883, the parties above named entered into a contract for the construction of a reservoir for increasing the water supply of Washington, D. C., whereby it was provided that the work should be completed by or before the 30th day of June, 1885.

And whereas the time for completing the aforesaid work has, by successive extensions, been prolonged to June 30, 1887—at which date the same was still unfinished—and the parties of the second part had made application for additional time in which to complete the work aforesaid;

Therefore this agreement witnesseth that the said Major G. J. Lydecker, Corps of Engineers, for and in behalf of the United States of America, and the said Maloney & Gleason, for themselves, their heirs, executors, and administrators, have mutually agreed, and by these presents do mutually covenant and agree, to and with each other, as follows:

That in consideration of a further extension of time, whereby the party of the second part may be allowed the additional period of four (4) calendar months (viz, from June 30, 1887, to October 31, 1887) within which to complete so much of the work on the reservoir aforesaid as shall be required of said party of the second part by the party of the first part, the party of the second part shall forfeit to the United States the sum of three hundred dollars ($300.00) per month during each month of such period of extension in order to make good, in part, the additional cost of supervision and inspection to which the United States will be subjected by reason of such extension; and the said sum of $300.00 shall be deducted monthly from the amounts found due to the parties of the second part, for each calendar month, or part thereof, during which operations, under the original contract hereinbefore referred to, dated October 30, 1883, and under these supplemental articles of agreement, shall be continued.

It is further understood and agreed that all provisions of the original contract aforesaid, not inconsistent with these supplemental articles of agreement, shall re-

main of full force and effect, and that nothing herein contained or implied shall bin
the United States to allowing the parties of the second part any additional time i
which to complete all the work required of them under the said original contract.

In witness whereof the undersigned have hereunto placed their hands and seals th
date first hereinbefore written.

Witnesses:

SIMON NEWTON.	G. J. LYDECKER. *Major Engineers,*	[SEAL.] *U. S. A.*
JNO. C. FAY. JOHN P. SHEPPERD.	MALONEY & GLEASON.	[SEAL.]

OFFICE CHIEF OF ENGINEERS,
U. S. ARMY,
July 26, 1887.

Respectfully submitted to the Secretary of War, with recommendation for approva

* * * * * * *

J. C. DUANE,
Brig. Gen., Chief of Engineers.

WAR DEPARTMENT, *July 28,* 1887.

Approved: By order of the Secretary of War.

SAM'L HODGKINS,
Acting Chief Clerk.

Work was continued until October 31, 1887, when the desired result
having been accomplished, operations under contract with Maloney &
Gleason were closed, and after considerable expenditure of time in surveys and recomputations for final settlement, payment was made Marc
19, 1888. This settlement was not satisfactory to the contractors, an
they have since that time presented claims for additional compensation
the consideration of which is now pending.

The total estimate for work done by the contractors on the reservoi
to the date of stopping work, and which was the basis of settlement wit
them, was as follows:

Items.	Work done.				
	To June 30, 1887.	During year ending June 30, 1888.	Total.	Price per yard, etc.	Cost.
Excavation, cubic yards	828, 515	44, 122	872, 637	$0. 30	$261, 791.
Puddling, cubic yards	61, 117	215	61, 332	. 40	24, 532.
Sodding, square yards	....	7, 440	7, 440	. 20	1, 488.
Cut stone masonry, cubic yards	4. 5	....	4. 5	15. 00	67.
Brick masonry, cubic yards	930	....	930	9. 00	8, 370.
Concrete masonry, cubic yards	9, 690	....	9, 690	5. 50	53, 295.
Rubble masonry, cubic yards	104	....	104	6. 00	624.
Trap-rock lining, square yards	5, 077	....	5, 077	1. 00	5, 077.
Broken stone lining, cubic yards	10, 177	2, 126	12, 303	2. 00	24, 606.
Paving, square yards	52, 690	9, 342	62, 032	. 28	17, 368.
Coping, linear feet	40. 9	....	40. 9	5. 00	204.
Cast-iron drains, linear feet	382	....	382	. 75	286.
Pine plank, M feet, B. M	90, 033	....	90, 033	30. 00	2, 700.
					400, 412.

Amount of forfeit to the United States for part cost of supervision and inspection, as per supplemental articles of agreement dated July 12, 1887	$1, 200.
Amount paid contractors	399, 212.
	400, 412.

Of the above total $21,678.36 is for work done during the past fisca
year. In addition, there has been expended for stone, trap-rock, an
brick furnished to contractors $43,032.90, and for surveys, engineering
contingencies, etc., since the beginning, the sum of $62,684.63, makin

the total expenditures to June 30, 1888, $504,929.88. The appropriations have been as follows:

Act approved July 15, 1882	$431,273.75
Act approved August 4, 1886	160,000.00
Total	591,273.75
Deducted therefrom the total of expenditures ($504,929.88), the balance available for completing the work at the close of the fiscal year was	86,343.87

In order to complete this part of the work to the extent necessary for service in connection with the increased water supply, a gate-house (combining influent and effluent) is to be built, the side slopes of reservoir in vicinity of gate-house graded and paved, and the circulating conduits built. The balance of appropriation in hand will probably be sufficient for the work above indicated. After that is done, requisite means for fencing and for properly finishing the grounds about the reservoir should be provided, but it is not deemed expedient to submit any estimate therefor at this time.

LAND.

The only payment for land during the year was that of May 26, to Martha J. Coston, for $77.50, on account of land to extend aqueduct. All previous payments are given in the Annual Reports of the Chief of Engineers for 1885, 1886, and 1887. Of the sum originally appropriated ($45,000), to pay for land and water rights at the Great Falls, only $117.96 has been expended, as stated in previous reports, no expenditure having been made therefrom during the past year. The settlement of questions concerning these matters is still pending in court, in charge of the Attorney-General.

The total expenditures made from this office on account of land condemnation up to June 30, 1888, is as follows:

For "land to extend aqueduct"	$26,439.51
For "land for reservoir"	209,435.72
For "water rights and land to extend dam at Great Falls"	117.96

The balances of appropriations available for the above-named purposes, June 30, 1888, were as follows:

For "land to extend aqueduct"	$24,930.49
For "land for reservoir"	814.28
For "water rights and land to extend dam at Great Falls"	44,882.04

MAIN CONNECTIONS.

No work has been done on the main connections during the year. In July a small force was employed to remove the 75-inch pipe, which had been left on the grounds of the Howard University, to the site of the new reservoir, at an expense of $19.40; the only disbursement during the year.

The total expended on account of main connections to June 30, 1888, were as follows:

For water-pipe, valves, and special castings	$122,029.78
For pay-rolls for labor, superintendence, etc	25,641.42
For materials, tools, supplies, etc	11,800.49
For hauling pipe from depots, etc	3,939.13
Total	163,410.82

The original appropriation was $165,400, and the balance now available is $1,989.18, which will probably suffice to complete this part of the work by making proper connection with the gate-house when built.

The following is an abstract of contracts for increasing the water supply of Washington, D. C., in force during the fiscal year ending June 30, 1888.

For tunnel.—Beckwith & Quackenbush, of Mohawk, N. Y., contractors; date of contract, October 29, 1883; dates of supplemental contracts, October 18, 1886, December 5, 1887, and May 8, 1888. The specified time for completing work under these several contracts is November 1, 1888, but it is not deemed possible to do so within that limit of time.

For reservoir.—Maloney & Gleason, of Washington, D. C., contractors; date of original contract, October 30, 1883; expired June 30, 1887, and extended under supplemental articles of agreement dated July 20, 1887, to October 31, 1887.

The following is a money statement for the fiscal year ending June 30, 1888:

Title of appropriation.	Amount unexpended July 1, 1887.	Expended during the year.	Amount unexpended June 30, 1888.	Outstanding liabilities, including retained percentages.	Amount available June 30, 1888.
Land to extend aqueduct	$25, 007. 99	$77. 50	$24, 930. 49	....	$24, 930. 4
Extension of aqueduct	*355, 000. 00 241, 777. 24	210, 207. 97	386, 569. 27	$43, 908. 08	342, 661. 1
Main connections	2, 008. 58	19. 40	1, 989. 18	....	1, 989. 1
Land for reservoir	814. 28	....	814. 28	....	814. 2
Constructing reservoir and gate-house	159, 646. 59	73, 302. 72	86, 343. 87	....	86, 343. 8
Water rights and land to extend dam at Great Falls	44, 882. 04	....	44, 882. 04	....	44, 882. 0
Completion and extension of dam at Great Falls	19, 665. 52	15, 000. 00	4, 665. 52	....	4, 665. 5
Aggregate	848, 802. 24	298, 607. 59	550, 194. 65	43, 908. 08	506, 286. 5

*Appropriated by act of March 30, 1888.

The above statement has reference only to disbursements made from this office; in addition, the sum of $611.24 was disbursed directly from the United States Treasury Department for advertising, but I have not been advised as to what specific item of appropriation such expenditure was charged. It related to the acquisition of land and water rights, and is supposed to have been charged accordingly. Deducting this amount ($611.24) from the total available June 30, 1888 ($506,286.57), leaves $505,675.33; of this amount an expenditure of the greater part of the balance applicable to the extension of the aqueduct ($342,661.19) is contemplated under existing contracts.

REPORT OF LIEUTENANT C. McD. TOWNSEND, CORPS OF ENGINEERS.

OFFICE OF THE WASHINGTON AQUEDUCT,
Washington, D. C., July 7, 1888.

MAJOR: I have the honor to submit the following report of the operations for "increasing the water supply of the city of Washington, D. C.," during the fiscal year ending June 30, 1888.

The project adopted in 1882 for increasing the water supply of the city of Washington consisted in completing the dam across the Maryland Channel and the Potomac River at Great Falls, building a dam across Conn's Island and the Virginia Channel, extending the conduit from the distributing reservoir to a ravine south of the Soldiers' Home by means of a tunnel, building in this ravine a reservoir of 300,000,000 gallons capacity, and connecting it with the distributing-pipes of the city by large iron water-mains.

At the close of the last fiscal year the dam at Great Falls had been completed; the water-mains had been laid, with the exception of a few lengths at the new gate-house; and the tunnel had been "holed," and 6,110.5 linear feet had been lined with brick and rubble masonry. To complete the reservoir so that water could be introduced required about 50,000 cubic yards of excavation, 12,000 square yards of paving, the construction of a gate-house over the eastern shaft of the tunnel, and the building of a conduit from the gate-house to cause a circulation of water in the reservoir. A description of the work done will be found fully explained in preceding reports.

During the fiscal year ending June 30, 1888, the excavation and paving of the reservoir has been completed, except in the gate-house recess, and no work can there be undertaken until lining in the heading from the east shaft of the tunnel has been completed and the cages employed in hoisting material have been removed.

The work of lining the tunnel was continued with a small force until September 30, when operations were suspended on account of a lack of funds. As the worst rock encountered had been lined, the tunnel was allowed to fill with water, not only from motives of economy, but also to test the strength of the lining already constructed. In the general deficiency bill approved March 30, 1888, Congress appropriated $355,000 to complete the lining of the tunnel, etc., with the proviso that the work should be finished November 1, 1888. The water was then pumped out and work was resumed, but it was not until the end of May that the building of the masonry arch could be actively commenced.

During the year 3,959.5 linear feet of the tunnel were lined with brick and rubble masonry, of which nearly one-third (1,186 feet) were constructed during the month of June. The total length of the tunnel lined is 10,069.5 feet. There remains to be lined 10,626.8 feet.

The following table shows the location of the various lined sections of the tunnel, the numbers under the heading "Class of lining" referring to the cross-sections submitted herewith:

Shaft.	Heading.	Length.	Class of lining.	Sections.	Linear feet.	No. feet to be lined.
East	West	3,317.1	1	318–746	428	
			1	946.8–1025	78.2	
			2	1025–1145	120	
			1	1145–1197	52	
			2	1197–1475	278	
			1	1475–1912	437	
			2	1912–3317.1	1,405.1	518.8
					2,798.3	
Champlain	East	3,348	3	078–228	150	
			4	228–866	638	
			2	2968–3348	380	2,180
					1,168	
	West	2,062	1	77.4–666	588.6	
			2	666–743	77	
			1	743–766	23	
			2	766–815	49	
			1	815–867	52	
			2	867–2062	1,195	77.4
					1,984.6	
Rock Creek	East	3,124.5	4	1304–1444	140	
			4	1753–1850	97	
			2	1850–3124.5	1,274.5	1,613
					1,511.5	
	West	3.552	4	104–258	154	
			3	1684.7–2239.3	554.6	
			2	2239.3–2574.8	335.5	
			3	3153–3363.5	210.5	2,297.4
					1,254.6	
Foundry Branch	East	2,875.7	4	096–362	266	2,609.7
	West	2,208	3	879.6–1085	205.4	
			2	1085–1197.6	112.6	
			3	1197.6–1329.6	132	
			2	1780.5–2208	427.5	1,330.5
					877.5	
West	East	209	2	0–9.8	9.8	
			1	9.8–56.7	46.9	
			2	56.7–209	152.3	....
					209.0	
Total	....	20,696.3	....	....	10,069.5	10,626.8

Note.—Brick-work of 4 rings was used in west heading Champlain avenue shaft between stations 815–846, 867–1050, 1390–1440. A 3-ring invert was built from 815–846. About 2,100 feet have been enlarged for lining and 379 feet of side-walls constructed.

As will be seen from the above method of lining the tunnel has been materially modified from time to time. The reasons for the change from dry-stone packing to a filling of rubble masonry have been fully explained in preceding reports. In the sections in which the invert is omitted there is no danger of the rock decomposing to an extent sufficient to endanger the stability of the side-walls, and the duty of the lining is merely to hold the rock in place. Section 4 is employed in rock considered solid enough to resist the pressure of water, and is introduced as a precautionary measure to prevent any possibility of the roof caving in.

If the tunnel could readily be emptied from time to time, it might have been advisable to have left these sections unlined, but the time necessary to pump out the water and make any repairs will be so long, and the discomfort to the citizens of Washington during that interval so great, that a reasonable expenditure should be made to reduce the chances of accident to a minimum. In this connection the record of the pumping out of the tunnel when work was resumed is submitted. The pumps employed were four Knowles's mining pumps, cylinders 10 inches and 6 inches, length of stroke, 12 inches, and one Cameron pump of corresponding size.

Pumping commenced at Rock Creek shaft with two pumps, March 26.

At the east shaft with one pump, March 28.

At Foundry Branch shaft with one pump, March 29.

At Champlain avenue shaft with one pump, April 6.

Foundry Branch shaft was cleared of water April 13; Rock Creek shaft, April 22; Champlain avenue, May 3; east shaft, May 16.

The extra pump at Rock Creek was transferred to the east shaft when the water in the former shaft had been reduced to a depth of 6 feet. The tunnel filled with water until it flowed out at Rock Creek in about one and one-half months.

The work will be vigorously prosecuted during the next fiscal year, but as it will not be completed on the 1st of November, as directed by act of Congress, it seems proper to explain fully the reasons therefor.

In previous years the course had been adopted of lining those sections of the tunnel in which the rock was bad, with the intention of leaving a large portion unlined, and the lining was therefore very irregularly distributed in the different headings. Thus in the west headings, from Champlain avenue and the east shafts, the work was nearly completed, while in the east heading from Foundry Branch no masonry had been laid.

In the bill approved March 30, 1888, the lining of the entire tunnel is authorized. The time necessary to complete the work now becomes a function of the rate of progress in the longest unlined heading. The operations of breaking down the rock to enlarge the tunnel for lining, and of laying the brick and rubble masonry, can be carried on simultaneously at many points, so that the rate of progress is limited only by the removal of the blasted rock and the introduction of brick and cement. By the substitution of rubble side-walls for brick, the work of hauling the material is expedited, as less stone is removed from the tunnel and less brick brought into it. Only a small force, however, can be used in loading the rock in cars, due to the small width of the tunnel, and it is found that, working continuously, the muck can be removed at a rate of but 20 feet per day when near the shaft. After the tunnel is lined the bottom must be cleaned and the tracks removed; the timbering in the working shafts must then be taken out and the shafts filled up. To complete the work in the time specified is therefore an impossibility. The attention of Congress should be called to this subject, as the proviso would appear to make the expenditure of the funds appropriated unlawful if the work is not completed at the time specified.

Very respectfully, your obedient servant,

C. McD. TOWNSEND.
First Lieut. of Engineers.

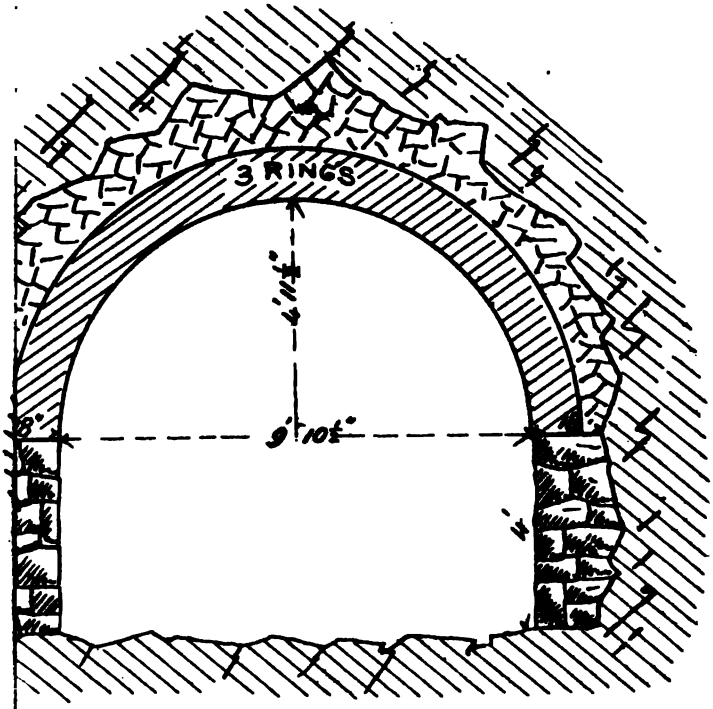
Maj. G. J. LYDECKER,
Corps of Engineers, U. S. A.

Y Y 3.

ERECTION OF FISH-WAYS AT GREAT FALLS OF THE POTOMAC.

No work has been in progress on the fish-ways during the past fiscal year, the balance of appropriation ($5,634.82) being insufficient for any useful work.

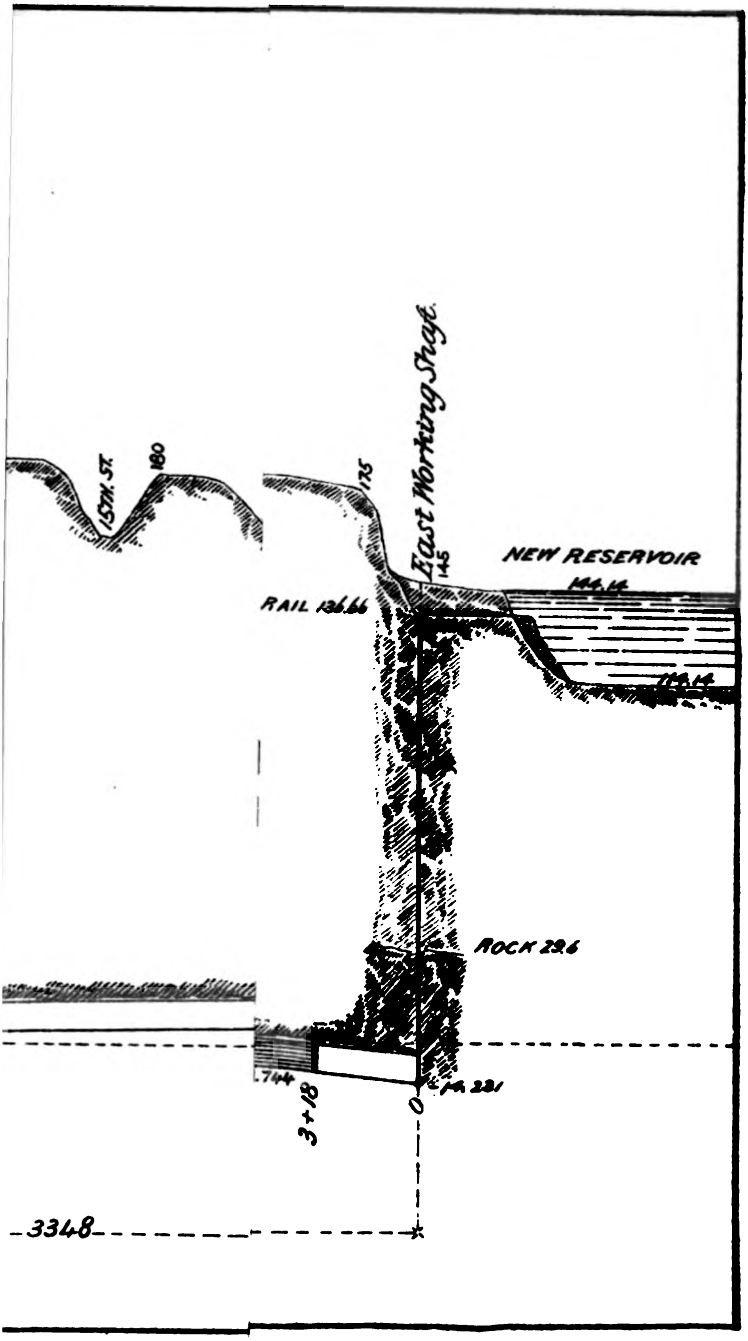
Congress has, however, at its recent session appropriated $25,000 for their completion, and the United States Commissioner of Fisheries, after having caused certain preliminary surveys to be made during the months



SECTION C.

18

Dup.


157TH. ST.
180
175
East Working Shaft
145
NEW RESERVOIR
144.14
RAIL 136.66
ROCK 29.6
.744
3+18
0
EL. 22.1
3348

y and June, is now engaged in the preparation of plans for carry-
n the work. It remains to be determimed whether this office is to
any further part or responsibility in the execution of the proposed
, this question being now pending in the War Department on my
mendation that the entire charge and responsibility are more
rly vested in the office of the United States Commissioner of Fish
Fisheries. In the mean time I have been directed to pay the ex-
es of the recent surveys, and bills to the amount of $435.50 have
rendered on account of work done to June 30, 1888.

e original appropriation for the work was $50,000, of which there
been expended prior to June 30, 1888, the sum of $44,365.18, leav-
4.82 as the balance then available.

e money statement for the year ending June 30, 1888, is as follows:

1, 1888, amount available		$5,634.82
nt appropriated by act of February 1, 1888		25,000.00
		30,634.82
1, 1888, amount expended during the fiscal year	$000.00	
1, 1888, outstanding liabilities for surveys in May and e, 1888	435.50	
		435.50
1, 1888, balance available		30,199.32

o estimate for further appropriation submitted.

APPENDIX Z Z.

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS IN THE DISTRICT OF COLUMBIA—WASHINGTON MONUMENT.

REPORT OF COLONEL JOHN M. WILSON, U. S. ARMY, OFFICER IN CHARGE, FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

1. Improvement and care of Public Buildings and Grounds in the District of Columbia.
2. Underground wires for telegraph and telephone service to connect the several Departments and Bureaus of the Government in Washington City.
3. Washington Monument.

Z Z 1.

IMPROVEMENT AND CARE OF PUBLIC BUILDINGS AND GROUNDS IN THE DISTRICT OF COLUMBIA.

OFFICE OF PUBLIC BUILDINGS AND GROUNDS,
Washington, D. C., July 3, 1888.

GENERAL: I have the honor to submit the following report of operations upon public buildings and grounds under the Chief of Engineers, carried on under this office during the fiscal year ending June 30, 1888.

In addition to these duties I have been in charge of the construction of the building for the Army Medical Museum and Library; the erection of a monument at Washington's headquarters, Newburgh, N. Y.; the erection of a monument to mark the birthplace of Washington; the improvements over the grave of Thomas Jefferson, at Monticello, Va., and since April 4, 1888, of the construction of the Washington Monument.

In accordance with the resolution of March 26, 1888, of the United States Senate, I prepared and submitted on April 9, 1888, a report presenting a comprehensive system of underground wires for telegraph and telephone service, to connect the several Departments and bureaus of the Government in Washington City.

GROUNDS SOUTH OF THE EXECUTIVE MANSION.

These grounds include those within the iron fence south of the White House, the road between the White House grounds and the Treasury Department, and the entire reservation between Fifteenth and Seventeenth streets, south of the White House, the Treasury, and the Stat War, and Navy Building, and north of B street.

Extensive repairs were made to the main road around the ellips about 600 cart-loads of gravel being used for this purpose.

The road between the Executive Mansion and the Treasury was als repaired and put in order.

A crosswalk 9 feet wide and 83 feet long, consisting of three rows o blue flagging with cobble-stone between them, was laid between th southeast gate of the Executive Mansion grounds and the sidewalk o the Treasury Department.

All gutters and drain traps were cleaned and repaired where necessary, trees and shrubs pruned, lawns mown and seeded down, and th reservation maintained in excellent condition during the season.

Early in the fall a temporary double plank foot-walk was laid betwee the east and west gates in the south grounds of the Executive Mansio for the convenience of foot passengers. This walk was removed in Ma 1888.

During the summer months all the roadways were sprinkled dail except Sunday in order to keep down the dust.

Within the iron fence the grounds were maintained in their usua beauty; roads and paths were kept in excellent condition, lawns mow and rolled, flower beds planted, and a number of new trees and shrub set out.

The main sewer near the south fountain having been damaged during a storm, was thoroughly repaired and the manhole rebuilt.

The fountain was repaired and cleaned out. Sixteen cart-loads of mud the sedimentary deposit of two years, were removed from the fountai basin.

On May 1, 1888, the northwestern portion of the reservation, whic for a number of years had been used as storage grounds while th construction of the State, War, and Navy Building was in progress, wa transferred to the care of this department.

Work was at once commenced improving this section, so that i would correspond with the remainder of the park. Four old woode buildings were taken down and the materials taken to the Nurser grounds for future use; about 208 loads of stone, 123 loads of old lumber, 172 loads of brick, 6 loads of old tiles, 11 loads of old iron, 100 ol boxes, and a large amount of other old materials were hauled from th grounds to the property yard, where they will be made useful in futur work upon the public grounds.

The entire grounds, except a small area in the southwest section, wa graded, old rubbish removed, old foundations taken out, and about 3,000 cart-loads of earth and 700 cubic yards of soil purchased and used for grading and top dressing. The line of the main road was laid ou preparatory to its construction after July 1.

A large amount of work was done in this section of the park. It is intended during the present season to remove the old wooden stables from the southwest corner of this portion of the reservation and to complete the improvement of this part of the park, except the necessary planting.

MONUMENT GROUNDS, GREENHOUSES AND NURSERY.

The operations in progress around the monument, grading and filling, have prevented the accomplishment of work of any character o the principal lawns.

The main road leading from B street to the Nursery grounds was repaired and rolled, about 700 cart-loads of gravel being used for this purpose.

A new walk was constructed on the west and south sides of the main road to the Nursery grounds. This walk is 5 feet wide and about 2,100 feet long; it was well bottomed with broken stone, covered with gravel, and rolled. About 150 cubic yards of broken stone and 250 cubic yards of gravel were used in its construction.

The lawn-surface between the nursery fence and the edge of this gravel-walk was graded, top-dressed with soil, and seeded down; it was well covered with grass in the spring of 1888.

The work in connection with the monument was transferred early in April, 1888, to the officer in charge of public buildings and grounds; it is understood that the Monument Commission, under the direction of which operations have been carried on for the past ten years, has recommended that in future the work shall be in charge of the War Department and all appropriations expended under the direction of the Secretary of War. Should Congress approve this recommendation it is probable that operations will hereafter be carried on under this office.

At the close of the fiscal year the main road and foot-path were in good condition, but owing to the grading and filling around the monument and the construction of the new marble lodge-house, about 480 feet east of the monument, it has been impossible to maintain the lawns in good order.

Extensive repairs were made to the greenhouses.

The superstructure of house No. 6 was entirely rebuilt and repainted; in house No. 5, 65 feet of new wall-plate was inserted and thirty new posts erected to support the roof; houses Nos. 3, 5, 7, 10, and 11 were reglazed; 850 feet of new staging 3 feet wide, and 200 feet 4 feet wide, were erected and 340 feet of old staging repaired; about 2,000 feet of new shelving was put up for the young plants propagated for the parks.

Four new water-tanks were constructed for the greenhouses and 800 linear feet of tin and copper guttering repaired.

The boilers of houses No. 6, 7, 8, and 9 were repaired. All furnaces and flues were cleaned and repaired where necessary, and 120 feet of 4-inch hot-water pipe placed in house No. 8.

In the propagating house the walk was lowered, a brick wall 97 feet long by 4¾ feet high built on each side, an entrance 6 feet square and 4¾ feet deep excavated and a door cut through on the north side. A new cold frame pit, 200 feet long by 6⅔ feet wide and 1½ feet deep was constructed.

Numerous minor repairs were made to all the greenhouses.

About 5,200 plants were placed under glass in the greenhouses for winter bloom, consisting of carnations, roses, bouvardias, sweet alyssum, begonias, mignonette, heliotrope, pansies, abutilons, geraniums, and smilax; about 1,500 pansies and violets were planted in cold frames; there were also potted and boxed for winter bloom 5,000 lilies of the valley, 6,000 hyacinths, 2,000 tulips, 2,000 freesia, 1,500 liliums, 1,000 narcissus, and 200 clumps of Astilbe Japonica.

During the winter and spring months the propagation of bedding plants for the parks was continued and about 350,000 ornamental foliage and flowering plants of about forty varieties were grown, nearly all of which were set out in the parks during the months of May and June, 1888.

A large number of palms, crotons, and subtropical plants were cared for in the greenhouses during the winter and used in park decorations during the summer.

At the nursery grounds the old condemned materials, the collectio of several years, were sold at public auction and the proceeds of th sale, $2,005.59, turned into the Treasury. As soon as these old mate rials were removed, the ground was plowed up and surface-soile and a portion of it planted with young trees and shrubs.

A new coal-house, 35 by 22 by 17 feet was put up and two new coa bins constructed; a new store-house for flower-pots, 18 by 16 by 12 fe was built, in which three closets were constructed and connected wi the main drain by 82 feet of 6-inch terra-cotta pipe; the old blacksmit shop, which was almost ready to fall down, was removed and a new fram building, 75 by 20 by 16 feet, constructed, mostly of old materials, f use as blacksmith's shop and store-house.

The old worn-out wooden fence around the nursery was removed an an iron fence, 1,274 feet long with four gates, erected; this fence wa made from portions of the iron fences removed from various reservations; 480 arbor vitæ trees were planted so as to form a hedge insid the fence.

New roads and walks were laid out and constructed, new gutters lai and improvements made to the sewerage, rendered necessary by wor on the Potomac flats.

The lawns were maintained in good order, the young trees and shrub properly cared for, gutters and drain-traps cleaned, and roads repaire and kept in order.

About 600 young trees and 800 shrubs were purchased and plante in the grounds; and about 2,400 seedling water oaks, raised at th nurseries, were set out.

About 375 deciduous and 100 evergreen trees, and 1,700 shrubs o different varieties, were lifted from the nursery grounds and planted i the various parks throughout the city.

I am frequently in receipt of requests for the loan of plants from th gardens for the use of churches, fairs, festivals, etc., and demands ar constantly made for decorative and other plants for private purposes in fact, orders are sometimes presented from members of Congress directing me to furnish plants.

I have been obliged to decline all requests for trees or plants, as eithe the loan or gift of them would be in violation of the following extrac from the act of Congress, approved June 20, 1878:

> *Provided*, That hereafter only such trees, shrubs, and plants shall be propagated a the greenhouses and nursery as are suitable for planting in the public reservation *to which purpose only* the said productions of the greenhouses and nursery shall be applied.

In the propagation of plants there are a few flowers blooming, and i has been a pleasure to this office to extend to Senators, Representatives, and other distinguished officials, and to churches, festivals, fairs, etc., the courtesy of sending them these blooms as far as the limited quantity will admit.

The requests for flowers are numerous, and all letters received in reference thereto are filed, and a complete record kept of those to whom flowers are sent.

SMITHSONIAN GROUNDS.

Extensive improvements were made in these grounds during th year.

The entire area around the new Medical Museum was graded, a larg portion of it covered with soil, and about 2,000 square yards sodded.

A granolithic pavement covering an area of $143\frac{2}{3}$ square feet, with $27\frac{5}{12}$ linear feet of curbing, was laid from the B street sidewalk to the steps of the Medical Museum, and a road, consisting of $208\frac{2}{3}$ square yards of coal-tar distillate and asphalt pavement was constructed from the main road through the grounds to the south front of the Museum.

The old shanties built sometime since by the authorities of the Smithsonian Institution, east of the National Museum, were torn down and the ground partially graded; this will be further improved during the coming fiscal year.

The main road in front of the Smithsonian Building was improved by extending the coal-tar distillate and asphalt pavement, over an area of 2,765 square yards from opposite the National Museum entrance to the west end of the Smithsonian Building; it is hoped to complete the improvement of this road through to Twelfth street during the coming fiscal year. The asphalt footwalk north of the Medical Museum was repaired over an area of $44\frac{5}{9}$ square yards; nearly all the other roads leading from Seventh, Tenth, and Twelfth streets to the Museum and Smithsonian buildings, covering an area of several thousand square yards, were repaired and resurfaced; about 1,700 cubic yards of gravel were used for this purpose, 1,400 of which were removed from the bed of the road where the asphalt pavement was constructed. One new brick drain-trap was constructed, $1\frac{1}{2}$ feet square and 3 feet deep.

The old brick and cobble-stone gutters on each side of the new asphalt roadway were taken up and 3,170 linear feet of cobble-stone gutter, 2 feet wide, was laid.

At the junction of the gravel and asphalt roads trap-rock aprons, covering an area of 360 square feet were laid.

The lawn north of the new pavement, near the Smithsonian Building, was graded and a portion of it, covering an area of 300 square yards, was sodded.

The post-and-chain fence on the south side of the reservation was removed and used around smaller reservations throughout the city.

During the year the lawns were covered in the early spring with guano compost, and in the summer season were regularly mown from time to time and rolled.

All roads were sprinkled during the summer, all walks, gutters, and drain-traps kept clean, trees and shrubs pruned and watered, and twenty-one old trees, which were no longer ornamental and which were rapidly going to decay, were removed.

A large flower-bed was laid out and planted in front of the National Museum.

HENRY (ARMORY) PARK AND SEATON PARK.

The usual work of care and protection was carried on and new improvements made as far as funds would admit.

All roads were repaired, rolled, and watered during the summer season, paths repaired, lawns mown from time to time, gutters and drain-traps cleaned, and trees and shrubs pruned.

The post-and-chain fence was removed from the south side of the reservation and used around smaller parks throughout the city.

In Henry Park about 2,000 cubic yards of earth were added to the mound around the Baltimore and Potomac Railroad depot, completing the amount required for the work.

The southern section of this mound for a length of 260 feet, varying in height from 2 to 11 feet, and in width of base from 10 to 75 feet was shaped, graded, surface-soiled, and seeded; the ground south o the mound and west of the railroad wall, over an area of about 70 square yards, was graded, covered with soil, and seeded. This section together with the complete portion of the mound, was covered with grass in the spring of 1888. Six hundred and twenty linear feet o walks 9 feet wide were laid out, bottomed with broken stone, and completed with gravel; 260 square yards of sod were laid along the borders of these walks. It is hoped that funds will be available this season for the completion of the mound and the grounds adjacent.

Twenty-seven handsome evergreen trees in these parks, near the railroad, which were being injured by the smoke from locomotives, were lifted and planted in other sections of the city. The places formerly occupied by them were filled with soil and sodded.

The lawn surfaces were repaired in various places where they had been injured by trespassers.

Extensive improvements are still necessary to complete these prominent and important parks.

RESERVATIONS NORTH OF PENNSYLVANIA AVENUE AND WEST OF THE CAPITOL.

This division of the city consists of fifty-eight improved reservations covering an area of about 109 acres, and located between First and Twenty-eighth streets west and B and Q streets north.

It includes the highly improved parks known as Washington Circle Rawlins Square, Du Pont Circle, Scott Circle and adjacent triangles Lafayette Square, Franklin Square, Farragut Square, McPherson Square, Thomas Circle, Mount Vernon Square, Iowa Circle, and Judiciary Square.

During the year the lawns were mown twice each month between May 15 and November 30, and watered during the dry season, the margins edged and trimmed, and bare places sodded and seeded down, the gutters and drain lodges were cleaned out once each month, the roads and paths weeded, raked, and rolled once in two months, the trees and shrubs pruned, cleared of caterpillars, and the young trees and shrubs and flower-beds watered during the dry season, new trees and shrubs were planted, and beds of ornamental foliage, flowering, and tropical plants set out. This is a part of the regular annual work, and is necessarily mentioned in the yearly reports.

During the winter season a large quantity of compost was prepared and spread over the lawns of the various parks and raked therein in the spring.

After the removal in the autumn, of the summer flowering and foliage plants, about 2,000 chrysanthemums were planted in the principal beds of Lafayette, Franklin, and Farragut parks. These continued to bloom until cut down by frost late in November, and contributed greatly t the beauty of the parks.

In November forty beds were planted in the various parks with early spring flowering bulbs, consisting of 7,294 hyacinths, 12,007 tulips, and 21,007 crocuses. These beds were subsequently coated with a heavy mulching of manure for protection during the winter. During the early spring the bulbs bloomed freely and attracted a great deal of attention by their beauty.

During the winter season plank foot-walks were laid on regular lines of travel through the south grounds of the Executive Mansion, Mount Vernon and Judiciary squares, and on the southern border of the Monument reservation.

The asphalt walks in Franklin and Lafayette squares were repaired, a new walk 585 feet long by 5 feet wide laid through Washington Circle on the line of Pennsylvania avenue, and new walks leading to and around the Rawlins statue laid in the reservation at the corner of Ninth street and Pennsylvania avenue.

The high iron railings were removed from the reservations on Pennsylvania avenue, between Thirteenth and Fourteenth streets and between Twenty-sixth and Twenty-seventh streets, the two reservations on New York avenue, between Tenth and Twelfth streets, and that on Massachusetts avenue, between Fifth and Sixth streets; post-and-chain fences were placed around four of these reservations; portions of the old fence were erected around the nursery grounds and the remainder sold at public action, and $1,001.51, the proceeds of the sale, turned into the United States Treasury.

The removal of these fences and the opening of the reservations to the public appears to have given general satisfaction.

The two reservations on New York avenue, between Tenth and Twelfth streets, Nos. 153 and 154, containing, respectively, 11,877 square feet and 5,726 square feet, were highly improved, gravel walks laid out, lawns resodded where necessary, flower-beds planted, and No. 153 extended to the sidewalk on the I street side.

The triangular reservation No. 139, on Rhode Island avenue, at the corner of Seventh and R streets, was graded, surface-soiled, sodded, and inclosed with a post-and-chain fence, and a flower-bed laid out and planted; this reservation had formerly been thickly planted with oak trees by the parking commission of the District of Columbia.

The triangular reservation No. 165, at the intersection of Indiana avenue and Third street, containing an area of 5,307 square feet, was graded, surface-soiled, sodded, planted with trees and shrubs, and surrounded with a post-and-chain fence; sixty-one flowering shrubs and eleven dwarf ornamental flowering trees were planted in this reservation.

Franklin Park was greatly improved by the removal of a number of old, decayed, and unsightly trees, principally Chinese arbor vitæ, balsam fir, and Norway fir; these trees were originally planted to temporarily improve the grounds until the more valuable trees obtained their growth; having outlived their usefulness they were removed. The lawn surfaces hitherto injured by the shade were at once sodded and seeded down, and the improved appearance of the park elicited favorable comment.

In Lafayette Square a few. old, decayed, and unsightly trees, similar to those removed from Franklin Park, were taken out and the lawns in the vicinity improved. In one particular instance an old soft maple was seriously injuring a magnificent copper beech; the removal of the maple has added greatly to the beauty of the beech, which is now one of the handsomest trees in the public grounds.

Attention is called to this matter of the removal of old trees, as it is not clearly understood, and the cutting down of a tree under any circumstances frequently causes unfavorable comment.

Repairs were made to the drainage of McPherson Square and a new drain laid from the lodge in Lafayette Square to the sewer in H street. This latter was necessary, the line being shorter and the old drain having been completely closed by the roots of trees.

At the Thomas Circle four white marble piers have been constructed on the outer boundary of the circle and the ornamental lamp-posts removed from the pedestal of the statue and placed on these new piers.

At reservation No. 71, intersection of Massachusetts avenue, Fifth and I streets, the post-and-chain fence on the east side, which had been thrown down by the party erecting a new building just east of the reservation, by authority of the building inspector of the District of Columbia, was again put up, about 6 feet west of its first position. The claim made was that under the building regulations of the city owners of lots could be authorized to control certain portions of the adjacent parking, and that the reservation being a portion of the parking the building inspector had the power to authorize the United States fence to be thrown down.

A small force of laborers were employed early in the winter months removing the cocoons of caterpillars from the bark of the large trees, from the park lodges, and from under the caps of the posts and other portion of the iron fences. About five bushels of cocoons were collected and destroyed.

The beautiful flower-beds in the parks have been greatly injured by dogs during the spring and summer. In order to partially protect them temporary light wire fences were placed around the most exposed beds.

GARFIELD STATUE.

In order to maintain the lawn surface in a presentable condition around the statue of General Garfield, it was found necessary to construct walks leading from the circumference of the circle to and around the statue; three granolithic walks were constructed from points opposite the spurs of the pedestal leading to a circular walk around it; in this work 243 linear feet of curbing and 1,096 square feet of pavement were laid, and 100 square yards of sod used in repairing the adjacent lawn surfaces.

RESERVATIONS EAST OF THE CAPITOL.

The improved reservations in this section of the city consist of Lincoln Square, Stanton Square, Folger Square, Marion Square, and twenty-three smaller parks on Pennsylvania avenue, Maryland avenue, Massachusetts avenue, and Delaware avenue.

During the year the following unimproved reservations have been graded, covered with soil, seeded, their borders sodded, post-and-chain fences erected, and water introduced: No. 84, containing 7,840 square feet, and located at the intersection of Massachusetts avenue, Ninth and B streets, northeast; No. 206, containing 7,837 square feet, and located at the intersection of North Carolina avenue, Eighth and B streets, southeast.

In these improvements there were used about 300 loads of earth, 175 cubic yards of soil, 250 square yards of sod, 80 posts, and 690 feet of chain.

Post-and-chain fences were erected around reservation No. 48, at the intersection of South Carolina avenue and Eighth street, east, and reservation No. 50, at the intersection of Pennsylvania avenue and Tenth street, east; 110 posts and 1,143 feet of chain were used in this work.

Board walks were laid through Stanton Park on the lines of travel in the autumn of 1887 and removed in the spring of 1888.

In Lincoln Park the drainage was improved by laying 165 feet of 4-inch pipe, and 84 feet of 8-inch pipe in trenches from 4½ to 6½ feet deep; thirty-eight trees, mostly evergreens, that were seriously injured during the blizzard of March 11, 1888, were removed from this park.

The usual care was given to all the improved reservations throughout this section of the city; roads and paths were repaired, edged, and rolled; gutters and drain-traps cleaned; trees and shrubs pruned, mulched, and watered; lawns covered with a mixture of guano and soil in the winter and mown from time to time during the summer season; and thirty flower-beds prepared and planted with ornamental foliage and flowering plants in the spring.

In the autumn of 1887 the flower-beds in Lincoln and Stanton parks were planted with 2,000 crocuses, 2,000 tulips, and 850 hyacinths; these added greatly to the beauty of the parks when they bloomed in the spring.

The trouble still continues in protecting the flower-beds in this section of the city; the blooming hyacinths and tulips have been plucked from time to time, and in May, 1888, over 100 vinca plants just set out were stolen in one night; in Folger and Stanton parks the flower-beds have been greatly damaged by dogs; much annoyance is also caused by chickens running at large and destroying the lawns and flower-beds.

The fountains in Lincoln and Stanton parks were repaired and put in working order. At the close of the year all the improved reservations in this section of the city were in comparatively good order.

RESERVATION NO. 17—GARFIELD PARK.

This large reservation, situated south of the Capitol, between South Capitol and Third streets east, contains an area of 24 acres. It is located in a section of the city which up to this time has not been highly improved by private enterprise; the Pennsylvania Railroad tracks run just outside its southern border, encroaching at one place upon the reservation.

The work of improvement was commenced in 1883 and up to the close of the present fiscal year the sum of $90,000 has been appropriated, all of which, with the exception of $1,500 returned to the Treasury in 1885, has been expended.

The original estimate of cost of the improvement was $135,000, it will require further expenditures of $45,000 to complete the work, of which $10,000 can be profitably used during the next fiscal year.

During the year the general work of the park consisted in mowing lawn surfaces twice each month between May and November, watering lawns and newly-planted trees and shrubs, repairing, raking, rolling, and edging roads and walks, and removing dead wood from trees and shrubs.

The special work of improvement consisted of the following: Three gravel paths were constructed, aggregating 900 feet long with a width of 10 feet and covering an area of 1,000 square yards; these paths were excavated to an average depth of 8 inches, the foundations formed of rubble stone and coarse gravel laid 5 inches deep and covered with 4 inches of fine gravel raked to an even surface and compactly rolled; about 165 yards of rubble and coarse gravel and 110 yards of fine gravel were used in this work; the borders of the walks were afterwards sodded and trimmed to proper outlines. Gravel roads were constructed connecting with the central drive in the western section of the park, from South Capitol street and Virginia avenue, Canal street and E street, New Jersey avenue and E street, and New Jersey avenue and F street; the aggregate length of these roads was about 1,200 feet with a width of 30 feet, and covering an area of about 4,000 square yards; a road about 900 feet long and 40 feet wide was partially constructed on the line of Virginia avenue to the intersection of New Jersey avenue and H street in the southern portion of the reservation.

These roads were excavated about 12 inches in depth, the foundation-courses, 9 inches deep, formed of rough rubble and coarse gravel, well rolled and packed, and, with the exception of the last mentioned, covered with about 6 inches of fine gravel, raked and rolled.

In these roads about 1,800 cubic yards of rubble and coarse grave and about 700 yards of screened gravel were used.

The ground in the vicinity of the Virginia avenue road was graded and partially covered with soil preparatory to making lawn surfaces. Paved entrances to park roads were constructed at the intersection o Virginia avenue and New Jersey avenue, E street and Canal street, and New Jersey avenue near E street; a coarse gravel bed for an entrance at the intersection of Second and H streets was also laid.

At these paved entrances blue-stone curbing was laid, and 630 squar feet of block pavement and 133 square yards of cobble-stone pavement put down. About 800 linear feet of cobble-stone gutters of an averag width of 2 feet was laid bordering the new roads.

During the year there have been planted in the park 322 deciduou trees, 136 evergreen trees, and 1,632 flowering shrubs; about 400 cubi yards of soil were used in planting these trees and shrubs; the trees were firmly secured in position by stakes and wires. About 6,500 trees and shrubs have been planted in this park during the past three years.

Portions of the improved grounds, formerly brought to established grades, where heavy fills had been made, had settled perceptibly in pas years; these were heavily dressed with good soil.

The winter of 1887–'88 was very severe on the young grass; the growt of the previous season and a portion of that on the lawn surface in th eastern section was killed; this was raked out, sown with rye and gras seed, and by June, 1888, was in excellent condition.

A number of trespass paths were raked, sown with seed, and protected by wire fences.

The improvement of the eastern section of the park is practically completed, and during the coming fiscal year it is hoped that considerabl progress will be made in the improvement of the western section.

PUBLIC RESERVATIONS OCCUPIED BY THE BALTIMORE AND POTOMAC RAILROAD COMPANY AND THE BALTIMORE AND OHIO RAILROAD COMPANY.

Attention is invited to the recommendation contained in my annual reports for 1886 and 1887 in reference to reservation No. 101.

This reservation, lying just south of the Smithsonian Park, contains about 2½ acres and is unimproved; it is partly occupied by the Baltimore and Potomac Railroad Company, the tracks of which run through the reservation. The laws under which the company claim authority fo their occupancy are fully set forth in my report for 1886.

The return of the reservation to the purpose for which it was originally intended, namely, a public park, for the adornment of the city, is earnestly urged by citizens living in the vicinity. Attention is invited to the fact that without authority of law, and in violation of section 223 of the Revised Statutes relating to the District of Columbia, the Baltimore and Potomac Railroad Company is now occupying United States reservations No. 174, 178, 241, and 309, and the Baltimore and Ohio Railroad Company is occupying Reservation No. 201.

I have reported fully, from time to time, the facts of the occupancy of these reservations by the railroad companies and the subject has been referred to the law officers of the Government.

Under date of September 12, 1887, Citizens' Association No. 3, through its secretary, Mr. Samuel H. Walker, requested me to include Reserva tion No. 201, now occupied by the Baltimore and Ohio Railroad Company, in my estimates for improvements during the coming year; the reservation covers an area of over a half acre, and its improvement will cost, including a post-and-chain fence around it, about $1,000; the Baltimore and Ohio Railroad Company claim that they are occupying the reservation with the assent of the District Commissioners, which they received in 1884, and that the company was offered a lease of the ground at that time.

Until the law officers of the Government succeed in dispossessing the company of the ground, or the company abandons it of its own volition, it will be useless to make any appropriation for its improvement.

Under date of October 15, 1887, I called upon the company in writing to remove its tracks from the reservation, and under date of October 20, 1887, received a reply, stating that it was the intention of the company to make, as soon as practicable, such other arrangements as would enable it to remove its tracks from the premises in question. At the close of the fiscal year the reservation was still occupied by the company.

It is hoped that some action will be taken to protect the property of the United States from being occupied by the railroad companies without authority of law.

SETTEES, MANURE, PAINTING IRON FENCES, TOOLS, AND REMOVING SNOW AND ICE.

One hundred and fifty new park settees were purchased during the year and distributed throughout the parks, making a total on the public grounds of 1,787; 233 old settees have been repaired and 292 repainted.

About 1,000 cubic yards of manure and 700 cubic yards of soil were purchased and thoroughly incorporated into rich compost; this was used in spreading over lawns and around trees and shrubs. In addition to the compost, 10 tons of guano was mixed with fine soil, and scattered over the lawns in the parks where compost was not used.

In addition to the removal of high iron fences and the erection of post-and-chain fences, as mentioned in the foregoing portions of this report, the iron fences, lamp-posts, drinking-fountains, vases, etc., have been painted at Lincoln, Stanton, and Folger parks, at 19 smaller reservations in the eastern section of the city on Massachusetts, Maryland, Pennsylvania, North Carolina, and South Carolina avenues, at Farragut Square, McPherson Square, DuPont Circle, Iowa Circle, Mount Vernon Square, 2 reservations on Connecticut avenue, 5 on Massachusetts avenue west, 2 at Scott Circle, 1 near Iowa Circle, 4 on Rhode Island avenue, and 6 on New York avenue.

The large fountains in Mount Vernon Park, at the intersection of Pennsylvania avenue and Twenty-eighth street, were painted, and also the vases and drinking-fountains in Judiciary Square, Washington Circle, Smithsonian Park, Lafayette Square, Lincoln Square, Franklin Square, and in various triangular parks throughout the city.

A blacksmith and helper were employed during the year repairing tools in daily use and new tools were purchased from time to time when needed; a large 600-gallon patent sprinkling-wagon, for use in keeping down the dust in summer, was purchased in May, 1888.

A large temporary force was employed after each snow-storm during the months of December, January, February, and March removing snow and ice.

The season was one of unexampled severity, and there were twelve snow-storms of more or less violence, requiring the removal of snow immediately after their cessation.

The first occurred on December 17 the fall was heavy, and necessitated the employment of about 150 men, at a cost of $200. The storm of January 25 was also a heavy one, necessitating the employment of over 200 men, at a cost of $275.

The total length of the paths and sidewalks under supervision of this office, from which snow must be removed after each storm, is about 16 miles, the area being over 30 acres; this year the appropriation was exhausted by March 15.

Owing to the small amounts heretofore appropriated the work is not always done satisfactorily, and frequently only one-half the sidewalks can be cleaned off; this sometimes causes bitter complaint from citizens, who blame the officer in charge for not doing better, when he is doing all that is possible with the means at his command.

It is earnestly recommended that an appropriation of $1,500 be made for removing snow and ice during the coming fiscal year.

FOUNTAINS, WATER-PIPES, AND FIRE-PLUGS.

There are 21 fountains with basins in charge of this office, located as follows: Executive Mansion Grounds, 2; Lincoln Square, 2; Stanton Square, 2; Rawlins Square, 2; and 1 each in Folger Square, Judiciary Square, Mount Vernon Square, Franklin Square, Iowa Circle and the reservations at Massachusetts avenue and Twentieth street, New York avenue and Third street, New York avenue and Tenth street, Pennsylvania avenue and Ninth street, Pennsylvania avenue and Nineteenth street, Pennsylvania avenue and Twenty-first street, Pennsylvania avenue and Twenty-eighth street, and Delaware avenue and First street, east. There are 25 drinking-fountains in the various parks.

All the fountains with basins have been repaired and put in good order, but owing to the limited supply of water it has been necessary to restrict their flow, except those in the Executive Mansion Grounds, to two or three hours daily. Repairs are constantly necessary to all the fountains, and much trouble has arisen from injury to the drains by sticks and stones thrown into the basins by children.

It becomes necessary to renew every spring the cups attached to the drinking-fountains, as during the year the chains are broken and cups stolen.

The necessary care was bestowed upon the water-pipes during the year; repairs were made from time to time; and in the late autumn the water was shut off from the parks, the hose-valves removed and stored for the winter. The valves were replaced in the spring and water turned on.

Water-pipes were introduced into the reservations at the intersection of Indian avenue and Third street west, Eighth and B streets southeast, and Ninth and A street northeast.

Extensive improvements were made in connections of the green-houses and nurseries with the water-mains in the Monument grounds and a much better supply of water obtained.

Seventeen hundred and fifty feet of hose has been purchased and used in connection with extending water-pipes.

Repairs were made from time to time to the pipes conveying the water from the spring situated in the new reservoir to the Capitol.

It was found that the pipe leading to the Capitol had been tapped for use of the Government Printing Office in May, 1885, and that the supply of water for the Capitol had been consequently reduced. At the request of this office, in November, 1887, the Public Printer directed that the pipe leading to his office should be disconnected. It is believed that other connections have been made with the pipe, but at what places has not yet been discovered.

In August, 1886, the spring-house was cleaned out and the connection with the main pipe carefully examined.

On laying bare the pipe at the spring-house a dip was discovered about 5 feet from the house, and a stop-valve, which was covered with 2 feet of earth. The fall of the pipe was about one-quarter of an inch to the foot. A wooden plug was found jammed in the joint of the pipe at the dip, which had evidently obstructed the flow of water for many years.

The outlet pipe passes diagonally through a stone block in the foundation; the chamber through the stone was cut down, the outlet lowered 5½ inches, the stop-cock placed inside the spring-house, and four lengths of pipe relaid in a concrete foundation with an even fall from the spring to the connection with the pipe-line.

South of the spring-house a space about 10 feet by 6 feet was laid bare to the foundation and two other pipes discovered, an upper one of wood and lower of iron; the upper was disconnected, but the lower was found to be connected with it about 5 feet below the surface; these pipes were at once closed with concrete so that the entire water supply should be used for the purposes originally intended. Since the completion of this work there appears to have been an ample supply of water at the Capitol.

Mr. Clifford Richardson, the chemist of the District of Columbia, who has recently made analyses of the water from the Franklin Square spring, the Capitol spring, the city spring at C street, Young's spring, C street, a well at Seventeenth and K streets, and the Potomac River, informed me under date of December 19, 1887, that the water from the Capitol spring was by far the purest that we have in the city.

PARK LAMPS AND LIGHTING.

The usual attention was given to the lamps during the year; a large number of lamp-posts were repainted, several lanterns replaced with larger ones, and others repaired where necessary.

The ornamental lamp-posts and lanterns were removed from the spurs of the pedestal of the statue at Thomas Circle and re-erected upon marble pedestals placed at the extremities of diameters of the circle, thus affording better light upon sidewalks.

There are in all 406 lamps and 481 burners belonging to the Department; one lamp was removed and one erected during the year.

The average number of lamps not connected with meters burning during the year was 318; each lamp burned about 2,600 hours and consumed about 15,600 feet of gas. In addition to these there were 71 lamps within the Executive Mansion Grounds, connected with the meter of the Mansion.

Attention is invited to the fact that the Grounds, south of the Executive Mansion, known as the White Lot, are without lamps of any kind. I suggested last year a tower 150 feet high, from which 6 arc lamps of 2,000-candle power each should be shown. Further consideration of the subject leads me to believe that a tower standing in the middle of the beautiful ellipse, with its guys to various points, would greatly disfigure it, and I therefore recommend that 7 iron posts, each 25 feet high, be erected around the ellipse, from which electric lights shall be shown the year round. The first cost of the work would be $1,000, the electric wires being underground; the cost of lighting would be 70 cents per lamp per night, or a total of $1,788.50 per annum.

JUDICIARY SQUARE AND GROUNDS AROUND THE NEW PENSION BUILDING.

Operations were resumed early in the fiscal year upon the improvement of the grounds around the Pension Building and in the other sections of the park.

The portion of the grounds west of the building, nearly 2 acres in extent, was reduced to the proper grade by the removal of about 4,000 cubic yards of earth; gravel roads and walks were constructed from F and G streets to the west entrance, the lawns laid out, covered with soil, their edges sodded, and the remainder sown with grass seed. The roads and walks in this section cover an area of 12,176 square feet, being 761 feet long by 16 feet wide. In constructing them there were used 300 cubic yards of rubble-stone and rough gravel and 225 cubic yards of fine gravel; 840 cubic yards of good surface loam and 500 square yards of sod were used on the lawns.

On the north front of the building about 2,100 cubic yards of earth were placed in position to bring this portion to the proper grade.

In the grounds south of the building the entrances to the main road at Fourth and Fifth streets were reconstructed, North River bluestone curbing being placed in position; at the Fourth-street entrance the roadbed for about 50 square yards was paved with trap-rock blocks, the sidewalk adjacent repaired, and the entire main road between Fourth and Fifth streets regraveled, rolled, and repaired.

A new gravel roadway was constructed from near the park lodge to the Pension Building; it covered an area of 5,575 square feet, being 223 feet long by 25 feet wide; two new drain-traps were built, 51 feet of 6-inch terra-cotta pipe laid to connect them with the main drains, and 73 feet of brick gutter laid connecting with the traps.

Two additional gravel walks connecting with the F-street road were constructed; their total length was 288 feet, with a width of 10 feet.

The low grounds bordering the roads were brought to proper level with good soil and sown down with grass seed.

A flower bed was constructed around the fountain and the adjacent gravel road widened.

Much attention was given to planting at this reservation; 372 flowering shrubs, 89 ornamental, deciduous, and 27 evergreen trees were set out in the immediate vicinity of the Pension Building; the evergreens were large, handsome trees, removed from Henry and Seaton parks, where they were being seriously injured by the smoke from the railroad locomotives.

Asphalt walks 684 feet long by 5 feet wide were constructed, leading from the Louisiana avenue and E street entrances to the City Hall, and a bluestone flag pavement 198 feet long by 3 feet wide was laid from a point midway between Louisiana avenue and E street to the same building; a cobble-stone gutter about 4 feet wide, covering an area of 38 square yards, was laid opposite the watchman's lodge, and a trap-rock crossing covering an area of 19 square yards laid across the gutter and asphalt walk for the convenience of teams going to the east entrance of the City Hall; about 36 square yards of trap-rock pavement was laid at the west entrance of the City Hall.

All roads and walks were graveled and repaired where necessary, and the asphalt walk on the line of E street between Fourth and Fifth repaired.

All lawns were mown and rolled from time to time during the season, gutters and drain-traps kept clean, trees and shrubs pruned and mulched, flower beds laid out and planted, and every effort made to maintain the entire park in as good condition as possible.

Much work is still required to be done, the grounds on the north and east of the Pension Building are yet to be improved, asphalt paths should be constructed leading to the building, and the main road south of the building, between Fourth and Fifth streets, should have an asphalt pavement.

It is hoped that the improvement of these grounds, except the asphalt roads, can be completed during the coming fiscal year.

EXECUTIVE MANSION.

The funds available for the care, repair, and refurnishing the Executive Mansion have been used as indicated, extensive repairs having been made to the furniture, which in many cases had become worn and shabby.

In the main vestibule the tile floor was repaired, the fresco work on the ceiling and side walls, which had become obscured by smoke, was cleaned and restored, and the wood-work, including front door, cleaned and repainted.

In the East Room the wood-work was repainted where necessary, one set of furniture reupholstered, the curtains thoroughly repaired, and a new sofa purchased for the center of the room.

In the Green Parlor a portion of the furniture was repaired and reupholstered, a new carpet laid in place of the badly-worn and shabby one that had been down for some years, and the fresco work of the ceiling was cleaned and restored.

In the blue parlor the wood-work was touched up with paint, a new carpet put down, the old soiled and worn furniture regilded and re-upholstered, and new heavy curtains put up, the old ones being transferred to one of the bed-rooms. New window-shades were hung in the south windows of the east room, the blue and red parlors. New matting was laid in the blue parlor in June, 1888.

The chandeliers of the green, blue, and red parlors and the State dining-room were cleaned, repaired, and regilded.

In the State dining-room the wood-work and walls were touched up with paint where necessary, and new lace curtains hung in the place of the worn and shabby sets that had been in use for several years. A number of the State dining-room chairs were re-upholstered.

The wood-work of the private dining-room was repainted. New linen covers were purchased for the furniture in the east room, main corridor, green parlor, and upper corridor.

On the second floor the wood-work of the corridor was touched up with paint where necessary, the library repainted, the wood-work of three of the office-rooms coated with hard-oil finish, and that of three bed-rooms repainted.

The furniture in the southwest bed-room was r-eupholstered, a part of the old carpet of the east room laid on the floor in place of the old, worn-out one formerly used; a set of shelves placed on mantlepiece, and other minor improvements made.

In the western portion of the upper corridor the old shabby furniture was repaired and re-upholstered, and one new sofa added; in the office portion of the upper corridor the leather sofas were re-upholstered and repaired. A new sofa was placed in the northwest bed-room, and some new table-covers purchased. A new bath-tub was placed in the bath-room.

The entire attic was whitewashed, a large storage closet built, and the copper pipes under the floor leading from the roof were enlarged and repaired. The new tin roof was repainted.

In the basement the wood-work of the engine-room and the iron doors of the furnace were painted; the entire corridor, laundry, kitchen, furnace-room, and outer area walls were whitewashed; a new closet was placed in the servants' bath-room and new washtubs in the laundry. The elevator pump was repaired several times and the elevator put in good order.

The sewer-pipe leading from kitchen to main sewer was taken up, cleaned out, and put back, and various repairs made to the sewers; the entire plumbing of the mansion was overhauled and put in complete order.

The house was draped with mourning in March on account of the death of the Chief Justice of the United States, and after the mourning was removed in April the front balcony and other portions of the north front, which had been badly stained, were painted.

A wooden storm-house was constructed around the west entrance on the basement floor. New linoleum was placed on the floors of the kitchen and pantry.

The ceiling of the south balcony, which was in a dangerous condition, was taken down and renewed; the old timbers and lathes to which the mortar was attached were found to be thoroughly decayed; the south balcony was repainted where necessary.

All windows and doors throughout the house needing attention were eased and repaired.

The entire gas-fixtures were cleaned, repaired, and put in complete order during the year.

All lace curtains were repaired and re-upholstered; all carpets (about 3,500 yards) laid and curtains hung in the autumn of 1887, and carpets taken up and shaken, and curtains taken down and stored away for the summer, in June, 1888.

The entire sewerage of the White House stables was overhauled and some necessary improvements made; the roof of the stable was repaired, two rooms were whitewashed, and various repairs made to windows and doors.

All furnaces, ranges, chimneys, and stoves were cleaned and repaired where necessary. Gas-fixtures were put up in one of the basement rooms, also in the stable and on the north and south fronts where awnings are placed during evening receptions.

Considerable repairs were made to the greenhouses.

The outside of the conservatory and the inside of two smaller greenhouses were painted; an entire new superstructure was constructed on the house opposite State, War, and Navy Building, the middle bed of the house raised, new iron and stone plant-benches placed in position, and the heating pipes re-arranged.

From some old brick and other old materials on hand a small additional structure was built to take the place of the old broken-down hotbeds.

The large rose-house was thoroughly repaired, iron columns placed in position to support the roof, new rafters and purlins introduced to replace those already decayed, and new shafting inserted for opening and closing ventilators.

In the Grapery new side benches and sills were constructed to replace those worn out and decayed, and the tin portion of the roof was repaired.

Every effort has been made to maintain these greenhouses, which were constructed previous to March, 1885, in as good condition as possible.

The decayed planks were removed from the floor of one of the rooms under the conservatory, the old brick taken up, cleaned and relaid, and a new brick tank constructed.

In the grounds of the mansion the lawns were regularly mown and raked, paths and roads repaired and rolled, trees and shrubs pruned, mulched and watered, flower beds laid out and planted with ornamental foliage and flowering plants, new trees and shrubs set out and a few dead ones removed.

The stone wall upon which the iron fence on the north front rests was thoroughly repaired.

Some minor repairs were made to the asphalt roads in the north grounds.

The fountains were repaired and maintained in good order.

TELEGRAPH CONNECTING THE CAPITOL WITH THE DEPARTMENTS AND GOVERNMENT PRINTING OFFICE.

The telegraph lines now under control of this office are as follows:

The line of overhead wires consists of 77 poles, covering a distance of about 3½ miles with a length of about 8 miles of wire; this line, starting from the State, War, and Navy Building runs to the Executive Mansion, thence to the Treasury Building, thence to G street, thence to Eighth street, thence to H street, thence to North Capitol street, and thence to the Capitol; connected with it is one running from the Treasury Department along Fourteenth street to the Bureau of Engraving and Printing.

It is hoped during the coming year to connect the new Pension Building with the main line along G street; authority to erect the necessary poles on Fifth street between G street and the Pension Building was asked some time since of the District Commissioners, and if granted the line will be completed as soon as funds are available.

There is about 500 feet of 13-conductor Patterson cable running from the cable-pole in the Capitol Grounds into the basement of the Senate, and 250 feet of 20-conductor cable running from the cable-pole on the corner of Seventeenth and G streets into the State, War, and Navy Building.

The under-ground cable now in use, known as the Waring anti-induction cable, consists of two 6-conductor cables running from the State, War, and Navy Building to the United States Senate and House of Representatives, a distance of 2.6 miles; this cable runs down Seventeenth street to New York avenue, through the grounds south of the Executive Mansion to Fifteenth street, along Fifteenth street to B street, along B street to Sixth street, thence to Missouri avenue, along Missouri avenue to Third street, along Third street to Pennsylvania avenue, along Pennsylvania avenue to First street, along First street to B street, thence to North Capitol street, and through the conduit into the Capitol building; about 1,500 feet of cable runs through the Capitol, and about 300 feet is used in connecting the Executive Mansion with the main cable.

The offices connected with these lines are as follows: Executive Mansion, United States Senate, United States House of Representatives, Treasury Department, State, War, and Navy Departments, Department of Justice, Post-Office Department, Department of the Interior, Government Printing Office, Signal Office, National Museum, and Office of Public Buildings and Grounds. Each office has two circuits and two sets of instruments except the Signal Office and Museum; each has from two to four cells in the local battery.

The main battery, located in the Office of Public Buildings and Grounds, has 80 cells for the overhead wires and 36 cells for the underground cable.

During the year the main battery was increased and, together with the local batteries, maintained in good condition; all crosses and obstructions of every kind were removed from the wires as rapidly as possible; the blizzard of March 11, 1888, did great damage, and it was several days before the overhead wires were in proper condition for work.

Six new poles were erected in place of those which were badly decayed; 4, decayed at the bottom, were cut off and reset and 4 straightened. The fixtures on the Winder Building were improved, and new ones erected on the Department of the Interior.

A new cable box was placed on the cable pole at the Capitol, and 20 feet of 13-conductor cable placed in the pole; 500 feet of cable was taken down in the basement of the Capitol and replaced in a better position.

The Office of the Department of Justice was refitted with instruments, and all the other instruments on the lines received attention from time to time.

The main office and battery were removed in February, 1888, from the corner of Seventeenth street and Pennsylvania avenue to the basement of the west wing of the State, War, and Navy Building.

In April, 1888, in accordance with a resolution of the United States Senate, a plan and estimate were submitted for a comprehensive system of underground wires for telegraph and telephone service to connect the several Departments and Bureaus of the Government in Washington City.

In view of the possibility of no appropriation being made for this new system, the estimate presented for the last two years is again submitted for replacing the present overhead wires with underground cables.

The overhead wires are daily becoming a greater and greater nuisance, and the experience after the March blizzard clearly shows the necessity of placing all wires under ground as soon as possible; the growth of the trees on the sidewalks has reached such a condition that during wet or windy weather the wires are almost useless.

To remove the entire overhead system and replace it with underground 6-wire cables will cost $8,500.

The overhead wires should be removed at once, and the United States can not well demand that private corporations shall bury their wires unless the Government takes the initiative and places its own wires under ground.

In the discharge of my official duties connected with the telegraph lines I have received intelligent and efficient assistance from Mr. A. J. Kennedy, the electrician and lineman on duty in this office.

SURVEYING AND DRAUGHTING.

The time of the only draughtsman allowed this office is mostly taken up with the care of the old records of Washington City. He is required to be in his office during the greater portion of each day to exhibit them to those interested, and is frequently summoned to produce the records in the courts.

During the year, in addition to these duties, he has prepared maps of Washington Circle, Iowa Circle, Du Pont Circle, Marion Park, Folger Park, grounds south of the Executive Mansion, Reservations 70, 71, 270, and 271, Reservations 45, 46, 47, 48, 49, and 50, Reservation No. 201, and a plan of the basement of the Executive Mansion showing sewer, water, and gas-pipes; he has also made a large map, on a scale of 1 inch to 30 feet, of the battle-field of Gettysburgh, in connection with erecting monuments to mark the positions held by the troops of the regular Army in that action, and has prepared drawings showing the plans of the engineer in charge for the proposed system of underground telephone and telegraph wires.

He has also devoted much time to careful examination to determine what, if any, lots in the city of Washington now occupied and claimed by private parties are still the property of the United States.

It is believed that there are a few such lots, but it is not deemed proper to even slightly cloud any title by an official report until it is absolutely certain that the Government has never parted with the land; the investigations will continue as time admits, and when completed a report will be made to the Secretary of War with request that the law officers of the Government take such action as may be deemed best to protect the interests of the United States.

It is earnestly urged that Congress will authorize the employment of a clerk to take charge of the old records; to properly arrange, index, and show them to parties interested will require the constant attention of a good clerk, and the only draughtsman allowed this office would then be permitted to devote his entire time to his legitimate duties.

NUMBER AND AREA OF RESERVATIONS AND NUMBER OF STATUES.

Condition, number, and area of reservations.

Description.	Number.	Area. *Feet.*
Total number of reservations	331	418.52
Reservations highly improved	57	231.42
Reservations partially improved	47	110.76
Reservations unimproved	227	71.34

Two have been added to the highly improved and two to the partially improved during the year; two of those formerly classed among the highly improved have been still more improved by paths, flower beds, park settees, etc., during the year.

Of the six reservations receiving extra improvements during the year, two were on New York avenue between Tenth and Twelfth streets northwest, one on Rhode Island avenue at the intersection of Seventh and R streets northwest, one on Indiana avenue at the intersection of Third and D streets northwest, one on Massachusetts avenue at the intersection of Ninth and B streets northeast, and one on North Carolina avenue at the intersection of Eighth and B streets southeast.

The effort has been to distribute all new improvements as equally as possible among the different sections of the city.

There are twelve statues in the public grounds under charge of this office, as follows: Washington, Greene, Jackson, Lincoln, Scott, Farragut, Thomas, Du Pont, Rawlins, McPherson, Garfield, and Henry; all of these, except the last, were carefully cleaned off during the year.

TREES AND SHRUBS.

In the report for 1886 a list was submitted of trees and shrubs forming the ornamental planting of the various parks in the public grounds under charge of this office; the list embraced a majority of the specie and varieties generally known that will thrive in the climate of Washington, and comprised in the aggregate over 32,000 specimens of tree and shrubs; since that date about 5,000 specimens have been planted out

As heretofore stated, it is intended to continue annually adding t the beauty of the parks by planting out varieties of trees and shrubs o decided merit.

From time to time it becomes necessary to remove some of the tree that were set out in the early planting of the grounds; great care is exercised, and a tree is never cut down unless it is badly decayed or by it growth is seriously injuring others of more value.

Efforts to prevent the injury of trees by caterpillars were continued, and in the winter of 1887-'88 several bushels of cocoons were gathered and destroyed.

ESTIMATES FOR THE FISCAL YEAR ENDING JUNE 30, 1890.

Salaries of employés public buildings and grounds, etc.:		
For one office clerk	$1,600.00	
For one messenger	840.00	
For one public gardener	2,000.00	
For one clerk in charge of old public records of Washington City	1,500.00	
For one electrician and telegraph lineman	1,000.00	
For overseers, foremen, draughtsman, gardeners, mechanics, and laborers	30,000.00	
For one day watchman at La Fayette Square	720.00	
For one day watchman at Franklin Square	720.00	
For two day watchmen in Smithsonian Grounds, at $660 each	1,320.00	
For two night watchmen in Smithsonian Grounds, at $720 each	1,440.00	
For one day watchman at Judiciary Square	660.00	
For one day watchman at Lincoln Square and adjacent reservations	660.00	
For one day watchman at Iowa Circle	660.00	
For one day watchman at Thomas Circle and neighboring reservations	660.00	
For one day watchman at Washington Circle and Rawlins Square	660.00	
For one day watchman at Du Pont Circle and neighboring reservations	660.00	
For one day watchman at McPherson and Farragut squares	660.00	
For one watchman at Stanton Square and neighboring reservations	660.00	
For two day watchmen at Henry (Armory) and Seaton squares and reservations east to the Botanical Gardens, at $660 each	1,320.00	
For one night watchman at Henry (Armory) and Seaton squares and reservations east to the Botanical Gardens	720.00	
For one day watchman at Mount Vernon Square and adjacent reservations	660.00	
For one day watchman at grounds south of Executive Mansion	660.00	
For one watchman for greenhouses and nursery	660.00	
For one day watchman for Marion Square, Folger Square, and adjacent reservations	660.00	
		$51,100.00
For contingent and incidental expenses	500.00	

Improvement and care of public grounds:		
For improvement of grounds north of the Executive Mansion	$2,500.00	
For improvement and maintenance of grounds south of the Executive Mansion	4,000.00	
For ordinary care of greenhouses and nursery	2,000.00	
For ordinary care of Lafayette Square	1,000.00	
For ordinary care of Franklin Square	1,000.00	
For care and improvement of Monument Grounds	5,000.00	
For continuing improvement of Reservation No. 17 and site of old canal northwest of same	10,000.00	
For construction and repair of post and chain fences and constructing stone coping around reservations	1,500.00	
For laying asphalt walks in various reservations	5,000.00	
For manure and hauling same	5,000.00	
For painting watchmen's lodges, iron fences, vases, lamps, and lamp-posts	1,000.00	
For purchase and repair of seats	1,000.00	
For purchase and repair of tools	2,000.00	
For trees, tree and plant stakes, labels, lime, whitewashing, and stock for nursery	3,000.00	
For removing snow and ice	1,500.00	
For flower-pots, twine, baskets, wire, splints, moss, and lycopodium	1,000.00	
For care, construction, and repair of fountains	1,500.00	
For abating nuisances	500.00	
For improvement, care, and maintenance of various reservations	20,000.00	
For improvement, care, and maintenance of Smithsonian Grounds, including construction of asphalt roads and paths	8,000.00	
For improvement and care of Henry and Seaton Parks, east to Botanical Gardens	2,500.00	
For improvement, care, and maintenance of Judiciary Square, including grounds around new Pension Building, and asphalt roads and walks leading to Pension Building	7,000.00	
For lodges for park watchmen in Stanton, Mount Vernon, Iowa, DuPont, Thomas, McPherson, and Folger reservations, at $500 each	$3,500.00	
For supplying and keeping supplied the 76 vases in the New Pension Building with suitable plants and shrubs and caring for same, in accordance with the joint resolution of Congress approved March 29, 1886	1,000.00	$90,500.00
Care of, repairs, fuel, etc., Executive Mansion:		
For care, repair, and refurnishing the Executive Mansion, to be expended by contract or otherwise, as the President may determine	16,000.00	
For fuel for Executive Mansion, greenhouses, and stable	3,000,00	
For care and necessary repair of greenhouses	5,000.00	24,000.00
Lighting the Executive Mansion and the public grounds:		
For erecting 7 iron posts each 25 feet high, and connecting them with underground wires for electric lights	1,000.00	
For electric lights for 365 nights, from 7 posts, at 70 cents per light per night, $4.90 per night	1,788.50	
For gas, pay of lamp-lighters, gas-fitters, and laborers, purchase, erection, and repair of lamps and lamp-posts, purchase of matches and repairs of all kinds; fuel and lights for office and office stable, for watchmen's lodges, and for green-houses at the nursery: *Provided*, That for each 6-foot burner not connected with a meter in the lamps on the public grounds no more than twenty dollars shall be paid per lamp for gas, including lighting, cleaning, and keeping in repair the lamps, under any expenditure provided for in this act; and said lamps shall burn not less than two thousand six hundred hours per annum; and authority is hereby given to substitute other illuminating material for the same or less price, and to use so much of the sum hereby appropriated as may be necessary for that purpose	14,000.00	16,788.50

Repairs to water-pipes:		
For repairing and extending water-pipes, purchase of apparatus for cleaning them, purchase of hose, and for cleaning the springs and repairing and renewing pipes of same that supply the Capitol, the Executive Mansion, and the building for the State, War and Navy Departments	$2,500.00	
		$2,500.
Telegraph to connect the Capitol with the Departments and the Government Printing Office:		
For replacing the entire overhead system of wires with duplicate six conductor underground cable, being a total distance of about 10,500 linear feet:		
Ditching, boxing, etc., 10,500 feet, at 22 cents	2,320.00	
110,000 feet of conductor, at 4½ cents per foot	4,950,00	
Supervising, expert joiners, electricians, etc., for 110,000 feet of conductor, at one-half cent per foot	550.00	
Contingencies, including taking cables into buildings	680.00	
	8,500.00	
For care and repair of existing lines	1,500.00	
		10,000.
Total		195,3[illegible]

In submitting these estimates, some of which are larger than here-t
fore appropriated and some for new work, the following explanation i
presented:

First.—One public gardener, $2,000. I have asked for an increas
in the salary of the public gardener, a position now so satisfactoril
filled by Mr. George H. Brown. The duties of the office require th
the gentleman who fills it shall be thoroughly skilled in the culture
trees, shrubs, and plants, and shall have a practical knowledge of ci
engineering as applied to landscape gardening. Mr. Brown combin
these attributes, to which he adds taste, industry, and integrity. H
duties take him from one end of the city to the other. He is directl
responsible for the care of the valuable collection of plants in the pro
agating garden, and superintends the propagation of plants that are a
nually raised for the public grounds, which this year numbered abo
350,000.

Second.—One clerk in charge of old public records of Washingto
City, 1,500.

These records include maps, deeds, record-books, letters, etc., fro
the organization of the original board of commissioners, near the clos
of the last century, up to 1887, when the duties were turned over to th
Chief of Engineers; they are constantly examined by attorneys an
others interested in lands in Washington and the person in charge
them is frequently required to produce them in courts; to index the
properly, to be able to turn at once to the details of any question raised
requires familiarity with every paper. This work has for the last fe
years been intrusted to the only draughtsman allowed this office, an
during the last six months more than half of his time has been act
ally employed on this duty.

I earnestly recommend that this appropriation be made in order tha
the draughtsman may be permitted to attend to the necessary an
legitimate duties of his office.

Third.—For one telegraph lineman, $1,000. Under the head of "tel
graph connecting the Capitol with Departments" will be found a fu
description of the telegraph system under charge of this office; it i
cludes about 8 miles of overhead wire and 2.6 miles of undergroun
cable; there are 17 offices connected with these lines, the main batter

being at this office; the lineman is constantly engaged in the care of the main and local batteries, and such necessary repairs and extensions as a system of wires of this kind requires; he is industrious, efficient, and capable, and has won the confidence of all with whom he has come in contact by faithful attention to his duties.

Fourth.—For overseers, foremen, draughtsmen, gardeners, mechanics, and laborers, $30,000.

I have submitted the same estimate as presented last year.

The grounds under charge of this office cover an area of 413½ acres, divided into 331 reservations scattered over various sections of the city. Of these reservations 57 are highly improved, 47 partially improved, and 227, covering an area of about 71½ acres, remain entirely unimproved.

Each year we improve from three to five of those heretofore untouched, thus adding to the beauty of the city and the welfare of the neighborhoods in which the reservations are situated. These new improvements are distributed throughout different sections of the city, and are only made where private enterprise has improved property in the vicinity. Each improved reservation adds that much to the expense of the care of the public grounds, the mowing of grass, care and construction of paths, care of trees and shrubs, etc.

It is earnestly recommended that this appropriation may be made in order that the beauty of these numerous parks, so ornamental to the nation's capital, may be maintained.

Fifth.—One day watchman at Lafayette Square, $720; one day watchman at Franklin Square, $720.

These men are earnest, faithful, and efficient; they have charge of the two handsomest parks in the city; they are busy every day of the year, and during the season of active operations are on duty from 8 a. m. till 8 p. m.

Sixth.—One day watchman for Marion Square, Folger Square, and adjacent reservations, $660.

These two reservations are highly improved, the one containing an area of about 1 acre, the other about 2 acres; in addition to these there are several smaller improved reservations in the vicinity; a watchman is very necessary in this locality, the nearest one being at Lincoln Square, a distance of half a mile, where his entire time is required.

Seventh.—For improvement of grounds north of the Executive Mansion, $2,500. It is proposed to remove the old broken asphalt walks now in very bad condition and to replace them with new materials and to resurface the old roadway leading from the main road to the greenhouses; the work will consist of constructing about 900 square yards of paths and resurfacing about 1,000 square yards of roadway.

Eighth.—For improvement, care, and maintenance of grounds south of the Executive Mansion, $4,000. These funds will be devoted to completing necessary drainage due to raising Potomac Flats, to continuing the improvement of the northwest section of the reservation, covering an area of about 2 acres, recently occupied as a storage ground in connection with the construction of the War, State, and Navy Building, to resurfacing roads and paths and constructing additional walks, and to care of lawns, planting trees and shrubs, etc.

Ninth.—For care and improvement of Monument Grounds, $5,000. In view of the work of filling around the monument and of the raising of the Potomac Flats, it will be necessary to continue improvements in the drainage system, the roads, paths, lawns, etc., in this reservation; the amount requested will be applied to these purposes.

Tenth.—For laying asphalt walks in various reservations, $5,000. I is proposed to replace with first-class asphalt walks the gravel paths i Washington Circle, Mount Vernon Square, Executive Mansion Ground (south side), Lincoln Square, Stanton Square, Folger Square, Mario Square, Henry and Seaton parks, and to renew those in Farragu Square and Iowa Circle. In the late fall, winter, and early spring thes walks are muddy, and pedestrians seek the lawns, which are thus destroyed by trespassers. The amount of these paths which it is propose to lay this year, is about 3,500 square yards. Each autumn it become necessary to put down plank walks, which must again be removed i the spring. If asphalt walks are laid the annual expense incident t plank walks will be avoided.

Eleventh.—For improvement, care, and maintenance of various reservations, $20,000.

The funds required under this head are for the purchase of material for, and the care of, the improved parks and for the improvement o as many as possible of the 227 unimproved reservations; each yea from three to five are added to the list of improved reservations, an if the funds now requested become available eight or ten can be adde during the fiscal year ending June 30, 1890; as reservations are thu improved the expense of the care of the whole is slightly increased for the improvements must be maintained.

Twelfth.—For the improvement, care, and maintenance of Smithsonian Grounds, including the construction of asphalt roads and paths $8,000.

This reservation, covering an area of over 58 acres, is the larges and one of the handsomest in the city, and has within its limits th Smithsonian Building, the National Museum, and the new Army Medical Museum.

The roads and paths, with one or two exceptions, are of gravel, an become dusty in summer and muddy in winter; a first-class asphalt road pavement is now in course of construction in front of the Smithsonian Building, running from Seventh to Twelfth street, a distance o about 1,700 feet and covering an area of about 7,500 square yards; 5,400 square yards has been laid, and it is hoped that a sufficient appropriation will be made to complete the whole road during the season of 1888. With the appropriation now requested it is proposed t lay about 1,500 square yards of roadway pavement, about 1,000 squar yards of asphalt paths leading through the park to the Museum, and to maintain in good condition the gravel roads and paths, gutters, lawns, trees, shrubs, and drainage of this handsome park.

Thirteenth.—For improvement, care, and maintenance of Henr (Armory) and Seaton parks, $2,500. These reservations, extendin from Seventh street to the Botanical Gardens, cover an area of 34 acres with road and walk surfaces of over 10,000 square yards. They ar in an advanced state of improvement. Their beauty has been marre by the depot and tracks of the Baltimore and Potomac Railroad. A mound has been constructed around the depot, upon which it is intended to plant trees and shrubs, so that in time the depot will be hidde partially from view. The materials for this mound have thus far bee obtained free of expense to the United States, and it is now propose to grade the mound and to seed and plant it. The funds requested ar needed for this purpose, and for the care of roads, lawns, gutters, etc. and laying out additional paths.

Fourteenth.—For improvement, care, and maintenance of Judiciar Square, including grounds around the new Pension Building, $7,000.

This square contains an area of 20 acres, and includes within its limits the court-house and the new Pension Building. It is crowded daily with persons having business in these buildings. The appropriation now requested will be used, if granted, for completing the improvements around the Pension Building, including asphalt roads and paths leading thereto, and in the general care of this large reservation.

Fifteenth.—For lodges for park watchmen in Stanton, Mount Vernon, Iowa, Du Pont, Thomas, McPherson, and Folger reservations, at $500 each; $3,500.

The watchmen in these reservations are exposed to the inclemency of the weather at all seasons of the year. Rain or shine, hot or cold, night or day, year in and out, they must be at their stations, and take shelter, when necessary, either under a tree or in such a dwelling or store as will offer its hospitality.

The dictates of humanity call for this appropriation.

Sixteenth.—For supplying and keeping supplied the vases in the new Pension Building with suitable plants and shrubs, $1,000.

The joint resolution of Congress approved March 29, 1886, requires that the seventy-six large vases on the upper corridor of the new Pension Building shall be filled and kept filled with suitable plants and shrubs. This estimate is submitted in order that I may be able to comply with the terms of the law.

Seventeenth.—For care, repair, and refurnishing the Executive Mansion, $16,000.

This old building needs continual repairs and repainting to maintain it in a neat and habitable condition. Much of the furniture is old and needs renewing, while new carpets are required in many of the rooms.

During the past eleven years the appropriations for this purpose have been as follows: 1878, $20,000; 1879, $25,000; 1880, $25,000; 1881, $20,000; 1882, $50,000; 1883, $40,000; 1884, $28,000; 1885, $22,500; 1886, $16,000, including $4,000 for new roof; 1887, $16,000; 1888, $16,000; 1889, $16,000. It will be observed that since July 1, 1885, the appropriations have been much less than previous to that time.

It is earnestly recommended that this appropriation be made, as it is absolutely necessary in order to maintain in a neat and habitable condition the mansion provided for the office and the residence of the Chief Executive of the nation.

Eighteenth.—For care and necessary repair of greenhouses, $5,000. The sum appropriated for this purpose during the past five years has been annually only $4,000, while in previous years it was $5,500. The greenhouses were constructed previous to 1885 under appropriations made by Congress, and need continual repair; they require the constant supervision of three experienced gardeners, while the assistance of laborers from time to time is necessary; at this time the wood-work of the superstructure of the main conservatory is in very bad condition and requires immediate and extensive repairs.

Nineteenth.—For erecting seven lamp-posts in the ellipse south of the Executive Mansion, from the top of which shall be shown electric lights, $1,000.

For electric lights for three hundred and sixty-five nights from seven lamps, at 70 cents per night each, $1,785.50.

The grounds south of the Executive Mansion, now highly improved, are without lights. It is believed that the electric lights mentioned above will shed a soft, mellow light over the entire reservation.

Twentieth.—For replacing the overhead wires between the Capitol and the Departments with a duplicate underground six-wire cable, $8,500.

This subject has been discussed in the preceding pages of this repo The growth of the trees on the sidewalks renders it absolutely nece sary, in order to maintain telegraphic communication over these wir either to erect at once taller poles at a cost of about $1,600, or to lay a underground cable at a cost of $8,500. The former plan is but a te porary expedient, as in time the overhead-wire system through citi must be abolished. The underground cable is far preferable, and favo able action upon this estimate is earnestly recommended.

Financial statement for fiscal year ending June 30, 1888.

Title of appropriations.	Available at beginning of fiscal year.	Expended during fiscal year.	Unexpen ed bala to be covered into th Treasur
Improvement and care of public grounds, 1888	$66,300	$66,058.41	$241.
Repairs, fuel, etc., Executive Mansion, 1888	24,500	24,493.58	6
Lighting, etc., Executive Mansion. etc., 1881	14.000	13,706.82	293.
Repairs to water-pipes and fire-plugs, 1888	2,500	2,086.78	413
Telegraph to connect the Capitol with the Departments and Government Printing Office, 1888	1,250	1,250.00	....
Contingent expenses, public buildings and grounds under Chief Engineer, 1888	500	499.73	.
Rent of office, public buildings and grounds under Chief Engineer, 1888	900	600.00	300
Salaries of employés, public buildings and grounds under Chief Engineer, 1888	45,620	45,601.05	18

It gives me pleasure again to express my appreciation of the efficie manner in which Mr. George H. Brown, the public gardener, and M E. F. Concklin, the overseer and chief clerk, have performed their va ous and important duties. It has been my good fortune to have the a sistance of these two gentlemen in the discharge of my official duti during the past three years, and I earnestly commend them for their u tiring energy and their fidelity to the interests of the Government an the work committed to their charge.

I am, general, very respectfully, your obedient servant,

JOHN M. WILSON,
Lieut. Col. Corps of Engineers,
Colonel U. S. Army.

The CHIEF OF ENGINEERS, U. S. A.

Z Z 2.

REPORT, WITH ESTIMATE, RESPECTING A COMPREHENSIVE SYSTEM O UNDERGROUND WIRES FOR TELEGRAPH AND TELEPHONE SERVIC TO CONNECT THE SEVERAL DEPARTMENTS AND BUREAUS OF TH GOVERNMENT IN WASHINGTON CITY.

OFFICE OF PUBLIC BUILDINGS AND GROUNDS,
Washington, D. C., April 9, 1888.

GENERAL: I have the honor to acknowledge the receipt of the fo lowing resolution of the United States Senate:

IN THE SENATE OF THE UNITED STATES,
March 26, 188

Resolved, That the Superintendent of Public Buildings and Grounds is hereby d rected to report to the Senate on or before Monday, the 16th day of April, 188 comprehensive system of underground wires for telegraph and telephone service, to connect the several Departments and Bureaus of the Government in Washington City, presenting in detail the same, and an itemized estimate of cost.

Attest:

ANSON G. MCCOOK,
Secretary.
By CHAS. W. JOHNSON,
Chief Clerk.

In compliance with the terms of this resolution I have the honor to submit the following report:

At this time the United States has no established Government system of telephone wires connecting the various Departments, and with the exception of two 6-conductor Waring anti-induction underground cables running from the State, War, and Navy Building through the Executive Mansion to the Capitol, the Government is entirely dependent for telegraphic facilities upon overhead wires.

These cables were laid in the fall of 1883 free of cost to the United States by the Standard Underground Cable Company, with the understanding that they should "be maintained at the expense of the company until March 1, 1884," * * * "and thereafter two of the cables to remain in the possession of the United States."

The United States overhead wires are now strung on low poles, and are a nuisance to which the public should no longer be subjected. The growth of trees on the sidewalks along the lines has reached such a condition that during wet or windy weather the wires are almost useless. For several days after the severe storm of March 11, 1888, the overhead lines were in a most demoralized condition, and had it not been for the underground cable, telegraphic communication between the Capitol and the Executive Mansion would have been impossible.

I have the honor to submit herewith a map of the city of Washington, showing the proposed routes for a comprehensive system of telegraph and telephone underground wires, connecting the several Departments and Bureaus of the Government in this city.

It is proposed to connect the different Departments by trunk lines, with branch lines leading to subsidiary points. The trunk routes are laid down in heavy red lines, the branch routes in broken red lines.

The Departments and Bureaus to be connected are as follows:

(1) TRUNK LINES.

Capitol, Government Printing Office, Pension Building, Interior Department, Post-Office Department, National Museum, Treasury Department, Department of Justice, Executive Mansion, State, War, and Navy Building.

(2) BRANCH LINES.

Winder Building, Signal Office, Naval Observatory, Bureau of Engraving and Printing, Propagating Gardens, Agricultural Department, Smithsonian Institution, Army Medical Museum, Armory, Coast Survey Building, Washington Barracks, navy-yard, and Marine Barracks.

The number of conductors, the total number of feet of conductors, an the number of linear feet of trench box to be laid are given in the fo lowing table:

Letters of reference on diagram B.	Location.	Linear feet of trench box.	No. conductors.	Total feet of conductors.
A.	Naval Observatory to corner Twenty-fourth and G streets NW	1,375	12	16,
B.	Chief Signal Office to corner Twenty-fourth and G streets NW	2,530	12	30,
C.	On G street from Twenty-fourth to Seventeenth NW	3,375	24	81,
D.	Northwest corner G and Seventeenth streets into subbasement State, War, and Navy Building	180	80	14,
E.	Northwest corner G and Seventeenth streets to entrance of Winder Building branch	220	56	12,
	Winder Building branch from main trench	20	12	
F.	From Winder Building branch to Executive Mansion branch	1,813	44	79,
	Executive Mansion branch from main trench	200	25	5,
G.	From Executive Mansion branch to Treasury Department branch	750	50	37,
	Treasury Department branch from main trench	187	29	5,
H.	From Treasury Department branch to diverging of the B street and F street lines	169	59	9,
I.	From diverging point on Fifteenth street to the corner of Fourteenth and B streets NW	2,100	27	56,
J.	On B street from Fourteenth to Ninth NW	2,250	25	56,
K.	From the corner of Ninth and B streets to the corner of First street and Pennsylvania avenue, via B, Sixth, Missouri avenue, Third, and Pennsylvania avenue	4,130	23	94,
L.	From the corner of Pennsylvania avenue and First street to the intersection North Capitol and B streets	1,390	24	33,
M.	From diverging point on Fifteenth street to north side of F street	365	34	12,
N.	From F street to Department of Justice	856	24	20,
O.	On F street from Fifteenth to Eighth NW	3,125	34	106,
P.	On F street from Eighth street to Interior and Post-Office Department branches	200	39	7,
	Interior Department branch from main trench	50	33	1,
	Post-Office Department branch from main trench	110	26	2,
Q.	From Post-Office Department branch to Pension Office branch	1,400	38	53,
	Pension Office branch from main trench	200	28	5,
R.	From Pension Office branch to the corner of North Capitol and F streets	2,360	30	70,
S.	On North Capitol street from F street to Government Printing Office	938	32	30,
T.	On North Capitol street from F street to intersection of North Capitol and B streets	1,970	22	43,
U.	From North Capitol and B streets to Capitol Building through conduit (500 feet)	....	46	23,
V.	National Museum branch from main trench	1,350	23	21,
W.	Cross town line on Ninth street, Louisiana avenue, and Eighth street, from B street to F street	2,110	5	10,
X.	Branch line from B street to Bureau of Engraving and Printing	1,900	14	26,
Y.	Bureau of Engraving and Printing branch from main trench	80	13	1,
Z.	From Fourteenth street to Propagating Garden	800	1	
AA.	Wires between Smithsonian Institution and Agricultural Department	1,030	9	9,
BB.	Wires between National Museum and Smithsonian Institution	620	10	6,
CC.	From National Museum to Army Medical Museum	430	6	2,
DD.	From Army Medical Museum to Armory Building	600	5	3,
EE.	On First street NW., B and South Capitol from Pennsylvania avenue to Office Coast Survey branch	2,310	13	30,
	Coast Survey Office branch from main trench	20	7	
FF.	From Coast Survey branch to corner of South Capitol and L streets	3,410	12	40,
GG.	From corner South Capitol and L streets, via South Capitol street and Georgia avenue, to Arsenal	4,940	10	49,
HH.	From corner South Capitol and L streets, via L, Sixth, and M streets, to navy-yard	4,420	12	53,
II.	Navy-yard branch from main trench	20	10	
JJ.	From navy-yard to Marine Barracks	1,350	10	13,
	Grand totals	57,644	......	1,183,
	Less cable already laid on B street route	....	......	167,
				1,001,

Attention is invited to the diagram marked (B), submitted herewith, which, with the preceding table, clearly shows the lines proposed.

The following tables will show how the various wires are to be used in the more important buildings:

STATE, WAR, AND NAVY BUILDING.

Trunk-line wires.	Wires.	Trunk-line wires.	Wires.
Three telegraph, 2 clock, and 1 alarm wire, 6 circuits	12	Telephone wires to—Continued. Government Printing Office	3
Telephone wires to—		Branch-lines wires from State, War, and Navy Building to—	
Executive Mansion	3		
Treasury Department	3	Naval Observatory	12
National Museum	1	Chief Signal Office	12
United States Senate	3	Winder Building	12
House of Representatives	3	Washington Barracks, Navy-Yard, Marine Barracks, and Propagating Gardens	4
Office of Attorney-General	3		
Interior Department	3		
Post-Office Department	3		
Pension Office	3	Total	86

EXECUTIVE MANSION.

Six telegraph circuits	12	Telephone wires to—Continued.	
Telephone wires to—		Office of Attorney-General	1
State, War, and Navy Building	3	Interior Department	1
Treasury	1	Post-Office Department	1
National Museum	1	Pension Office	1
United States Senate	1	Government Printing Office	1
House of Representatives	1		
		Total	24

TREASURY DEPARTMENT.

Six telegraph circuits	12	Telephone wires to—Continued.	
Telephone wires to—		Pension Office	1
State, War, and Navy Building	3	Government Printing Office	2
Executive Mansion	1		
National Museum	1		28
United States Senate	2	Branch-line wire:	
House of Representatives	2	Bureau of Engraving and Printing	1
Office of Attorney-General	1		
Interior Department	2	Total	29
Post-Office Department	1		

DEPARTMENT OF JUSTICE.

Six telegraph circuits	12	Telephone wires to—Continued.	
Telephone wires to—		National Museum	1
State, War, and Navy Building	3	United States Senate	1
Executive Mansion	1	House of Representatives	1
Treasury Department	1	Post-Office Department	1
Interior Department	1		
Pension Office	1	Total	24
Government Printing Office	1		

DEPARTMENT OF INTERIOR.

Six telegraph circuits	12	Telephone wires to—Continued.	
Telephone wires to—		Government Printing Office	2
State, War, and Navy Building	3	National Museum	2
Executive Mansion	1	United States Senate	2
Treasury Department	2	House of Representatives	2
Office of Attorney-General	1		
Post-Office Department	2	Total	33
Pension Office	4		

act of August 2, 1876, for the completion of the Washington Monument was dissolved at its own request, and the Secretary of War was charged with the custody, care, and protection of the monument.

Since December 1, 1887, operations have been in progress under contract with Mr. Thomas H. Lyons, of Baltimore, constructing an earthen embankment around the monument; during this period he has deposited about 120,000 cubic yards of earth in position, making in all about 205,000 cubic yards deposited under his contract.

The total amount that will be contained in the mound when completed has been determined by accurate calculation to be 267,412 cubic yards, of which 250,000 yards are to be furnished by Mr. Lyons under his contract. Careful instrumental surveys have been made from time to time in order to accurately determine the quantities of earth in position delivered by the contractor.

The steam machinery and the electric light plant have been put in running order, and under the terms of the act of October 2, 1888 (sundry civil bill), the elevator and machinery connected therewith will be started at an early day.

On the 18th of February, 1888, proposals were invited for the construction, at the expense of the Washington Monument Society, of a marble lodge house, to be situated about 40 feet from the monument. The contract was awarded to Messrs. Lane & Malnati, of this city, for the sum of $10,720. The location was afterwards changed by direction of the Monument Commission to a position about 480 feet east of the monument, and for the necessary work connected with this change an additional sum of $930 was allowed the contractors by the Commission.

Operations were commenced early in April at the original site selected, but suspended in May and again resumed early in June at the new site. The progress of the work has been slow but the character of the materials and construction has been satisfactory. At the close of September, 1888, the walls of the building were nearly completed.

During the present fiscal year it is proposed to finish the construction of the terrace under contract, to cover its entire area with good soil, to seed it down, to commence laying out roads and walks, to complete the new lodge, to begin a system of drainage for the grounds, to insert in the walls of the monument the memorial stones on hand, and to maintain in good order the machinery connected with the elevator and electric lights.

The following estimate for operating the elevator, the electric lights, and machinery connected therewith, for the fiscal year ending June 30, 1890, is submitted:

One custodian, at $100 per month	$1,200
One steam engineer, at $80 per month	960
One assistant steam engineer, at $60 per month	720
One fireman, at $50 per month	600
One assistant fireman, at $45 per month	540
One conductor of elevator car, at $75 per month	900
One attendant on floor, at $45 per month	540
One attendant on top floor, at $45 per month	540
Three night and day watchmen, at $60 per month	2,160
Fuel, lights, oil, waste, packing, tools, matches, paints, brushes, brooms, lanterns, rope, nails, screws, lead, electric lights, heating apparatus, oil stoves for elevator car and upper and lower floor, repairs to engines, boilers, dynamo, elevator, and repairs of all kinds connected with the monument and machinery, and purchase of all necessary articles for keeping the monument, machinery, elevator, and electric light plant in good order	2,340
	10,500

An estimate for continuing the improvement of the grounds around the monument has been submitted in my report upon Public Buildings and Grounds for the last fiscal year.

Statement of expenditures from December 1, 1887, *to September* 30, 1888.

Balance on hand December 1, 1887		$74,927.61
Appropriation of October 2, 1888		27,500.00
Total		102,427.61
Amount expended up to September 30, 1888	$44,853.02	
Amount covered by existing contracts	30,074.59	
		74,927.61
Amount available October 2, 1888		27,500.00

Very respectfully, your obedient servant,

JOHN M. WILSON,
Lieut. Col. Corps of Engineers,
Colonel U. S. Army.

The CHIEF OF ENGINEERS, U. S. A.

APPENDIX A A A.

CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES IN THE YELLOWSTONE NATIONAL PARK.

ANNUAL REPORT OF MAJOR CHARLES J. ALLEN, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

UNITED STATES ENGINEER OFFICE,
Saint Paul, Minn., July 6, 1888.

SIR: I have the honor to forward herewith my report, in duplicate, upon the improvement and construction of roads and bridges in the Yellowstone National Park for the fiscal year ending June 30, 1888.

Very respectfully, your obedient servant,

CHAS. J. ALLEN,
Major of Engineers.

The CHIEF OF ENGINEERS, U. S. A.

CONSTRUCTION AND IMPROVEMENT OF ROADS AND BRIDGES IN THE YELLOWSTONE NATIONAL PARK.

[In charge of Capt. Clinton B. Sears, Corps of Engineers, until April 16, 1888. Since that date in charge of Maj. Charles J. Allen, Corps of Engineers.]

The beginning of systematic road and bridge construction in the park followed an appropriation of $40,000 made by act of Congress approved March 3, 1883, the portion of the appropriation allotted to construction work to be expended under the supervision and direction of an engineer officer detailed by the Secretary of War.

Capt. D. C. Kingman was the officer so detailed. He continued in charge until April 1, 1887, when he was relieved by Captain Sears.

Those officers accomplished a large amount of excellent work in repairing old roads and in opening routes to regions in the park theretofore inaccessible to tourists.

The project for this improvement consists in repairing old trails and in the construction of substantial roads, about 18 feet in width, well crowned, ditched and drained, with easy grades, and, where necessary, covered with gravel or broken rock; also, the building of good bridges over the streams. The permanent roads to cover a circuit of about 145 miles, extending from the park line at Gardiner, Mont., to the Mammoth Hot Springs; thence to Norris Geyser Basin; thence to Upper

Geyser Basin; thence to Yellowstone Lake via Shoshone Lake, acros the great continental divide of the Rocky Mountains; thence along th Yellowstone Lake and Yellowstone River via the Falls and the Gran Cañon to Yancy's; thence to the Mammoth Hot Springs. In addition a cross-road from the Firehole Basin to the Falls of the Yellowstone a cross-road from the latter to the Norris Basin; a road from the wes line of the park to the Firehole Basin; a road from Yancy's to the eas line of the park, and a number of short branch roads and trails from th intersections of the above-named roads to minor objects of interest o the main lines of travel; in all, about 225 miles of new road, abou twenty large and fifty small bridges, and many culverts contemplate in the project. Cost of completion of the project, as estimated in th Annual Report, 1887, $250,000.

The condition of the roads and bridges before the adoption of th present project was deplorable. The roads, few in number and shor in extent, were mere wagon trails; the grades were frequently excess ively steep, and the roads full of stumps, rocks, boggy places, and da erous side-hill slants.

The foregoing is derived from the Annual Report of the Chief of En gineers for 1887, and from Appendix A A A to the same.

Following is a statement of the work accomplished by Captain Sear in the past fiscal year, from memoranda furnished by him :

On July 1, 1887, the appropriation for the new fiscal year became available, an three working parties, provided with the proper camp outfit, tools, teams, etc., wer put into the field and began work, which was continued uninterruptedly up to Oc tober 15, 1887, when all parties were withdrawn and discharged, and the plant store for the winter in charge of a watchman.

One party began at Gibbon Meadow, near the entrance to the cañon, and worke north toward Norris Geyser Basin, building a new permanent road, which was fin ished to the latter point. A considerable portion of the road was through a heav meadow soil, soaked with water, requiring much deep ditching, many culverts, an numerous drains.

The rest was through heavy timber. The total length was about 4 miles. Th line adopted was almost entirely new, and but little of the old road was utilized.

Another party began operations on the road from Norris Basin to the Falls an Grand Cañon, taking up the work where it was left off at the close of the last seaso This road was completed to within a mile of the Falls, and partially built to within one fourth of a mile of same. The total length of road built on this section was equivale to about 6 miles of new road. The greater portion of this was through heavy timbe and about half a mile in Virginia Cañon required retaining-walls of dry bowlde masonry.

A third party started at the end of last year's completed road near Beaver Lak and worked toward Swan Lake Meadow on the line of the main road to the Mam moth Hot Springs. The line followed was entirely new and none of the old roa was used. Most of the route lay through quite heavy timber and required muc clearing and grubbing, and, being partly on wet side hill, necessitated deep ditche numerous drains, and many culverts. The length of road built was about 6 miles.

A king-post truss-bridge of 30 feet span was built over Obsidian Creek.

In addition to the above small parties were detached from time to time to cut sid trails, and to temporarily repair the original improved roads so as to keep them i passable condition, and to clear the improved roads of fallen timber. The principa trail work was the construction of a 4-foot bridle path of easy grade from the old tra a short distance beyond the bridge over Cascade Creek, towards the crest of the lowe falls of the Yellowstone.

All roads were cleared of timber for a width of 30 feet, and graded, crowned, an finished to a width of from 18 to 20 feet, exclusive of side drains. All bridges an culverts were covered with 3-inch planks, and the total number built was 43.

The total work done during the season from July 1 to October 15 was equivalent t the entire construction of about 18 miles of new road cleared, grubbed, plowe graded, and finished. Of this, about 55,000 feet was through heavy timber, and som 10,000 feet through meadow and prairie land; the balance being of varied characte through light timber or on open side hill, etc.

The sum turned over to me April 16, 1888, was $835.22.

With these funds some necessary repairs were made to the roads, bridge-piers, and the retaining-wall in Virgina Cañon. The work was performed by hired labor.

Repairs are always necessary more or less in the spring, as rock, bowlders, and earth are moved from the hill and mountain sides under the action of frost and spring thaws and rains, and the storms of winter uproot trees, many of which fall across the roads. As the mileage of roads increases, the annual outlay necessary for repairs will increase.

The principal work performed under the Engineer Department may be summarized as follows:

Miles of new road built	58½
Miles of roads (original wagon trails) mended	90
Miles of new roads repaired (about)	45½
Number of large bridges built	6
Number of small bridges built	13
And many culverts.	

Some of the new work was through heavy rock cutting.

Expended during the fiscal year ending June 30, 1888	$20,000.00
Expended since the adoption of the present project	109,779.42
Under the appropriation of 1883	23,570.03
Under the appropriation of 1884	23,000.02
Under the appropriation of 1885	23,209.37
*Total to June 30, 1886	69,779.42
Under the appropriation approved August 4, 1886	20,000.00
Under the appropriation approved March 3, 1887	20,000.00
Total to June 30, 1888	109,779.42

The roads and bridges constructed and kept in repair under the present project are generally in very good condition, but the entire project as to extent of roads and bridges must be carried out before the park will fully attain the object for which it was established by Congress. All roads in the park should be well constructed, not only with a view to permanency, but also to appearance. They should not be behind those of any public park in the United States. In constructing them I favor an increase in width over the present gauge where sharp turns occur, especially on hillsides or where the roads border precipices, and, n the latter cases, providing them with substantial parapets. Parapets, as mentioned, will add something to the cost of construction, but they are to a certain extent necessary, and, where possible, the construction work, bridges especially, should be in harmony with the character of country. These particulars can not, probably, all be attempted for some years to come, but I believe that they will eventually receive consideration.

As the number of tourists in the park increase some extension of roads, bridges, and bridle-paths beyond what the present project contemplates may eventually become necessary, and with that in view further explorations and reconnaissances in the park by the engineers should be provided for.

I heartily indorse the views of the officers who preceded me in charge of this work, that the National Park should be maintained for the purpose for which Congress established it, viz, for a public park for the benefit and enjoyment of the people. Its many objects of interest should be readily, safely, and cheaply accessible, and this can best be accomplished by providing liberal and regular appropriations for the work.

---

* See page 3135, Appendix A A A, Part 4, Annual Report of the Chief of Engineers, 887.

The last annual report estimated $130,000 as the sum needed for th fiscal year ending June 30, 1889. I renew that estimate for the yea ending June 30, 1890, and would urge, in connection with the estimat the advantage of an early appropriation. The season for work i the park is short, and in case an appropriation for the fiscal year i made late in the season, the short time available to the engineer fo planning his work and organizing for the same places him and the im provement and all concerned at a great disadvantage. On the othe hand, an appropriation made, say, in February or March, affords tim for maturing plans, so as to take the field promptly on the 1st of Jul and thereby accomplish a good amount of creditable work before col weather sets in.

The last annual report states the necessity for the purchase of a port able steam saw-mill and a portable rock-crusher, and for the construc tion of a warehouse, stable, and office; also, for a dwelling-house fo overseer and watchman. During my visit to the park in June last th necessity for this outlay was apparent. The dwelling-house is neede in winter, as well as in summer, by the watchman in charge of the en gineer plant. In fact, it will always be necessary to keep some one i the park to inspect and repair roads and bridges, and that employ should have comfortable quarters for himself and family. The winter in the park are long and severe, and the hotels are then closed, so tha the watchman is for months almost shut out from the rest of the worl The buildings should be located at Mammoth Hot Springs.

It is proposed to expend the $130,000 estimated as needed for th year ending June 30, 1890, so far as it will go, about as follows:

In completing the belt road, by continuing the existing road from th Upper Geyser Basin to and around Shoshone Lake; thence across th Great Continental Divide to the Yellowstone Lake; thence along th lake to the Yellowstone River; thence along the river to the Gran Cañon; thence to Yancy's; thence to the Mammoth Hot Springs, im proving and completing the old rough road between those points; als in repairing and completing the roads already built or commenced un der the present project; in repairing old trails where necessary, and i opening and constructing such cross-roads and bridle-paths as may b immediately needed; also, in purchasing the plant and constructing th buildings needed for the work.

I wish, in conclusion, to acknowledge the valuable assistance ren dered me by Mr. E. Lamartine during the portion of the fiscal year i which the work has been in my charge. Mr. Lamartine's connectio with work upon roads and bridges in the park extends over six or seve years, and the value of his services has been fully acknowledged by th officers preceding me in charge.

Money statement.

Amount appropriated by act of March 3, 1887		$20,000
July 1, 1888, amount expended during fiscal year, exclusive of liabilities outstanding July 1, 1887	$19,716.84	
July 1, 1888, outstanding liabilities	283.16	
		20,000

Amount (estimated) required for completion of existing project	230,000
Amount that can be profitably expended in fiscal year ending June 30, 1890	130,000
Submitted in compliance with requirements of sections 2 of river and harbor acts of 1866 and 1867.	

APPENDIX B B B.

B B B 1.

ANNUAL WATER-LEVELS OF THE NORTHERN AND NORTHWESTERN LAKES.

Tri-daily observations of water-gauges were made at the following places from July 1, 1887, to June 30, 1888: Charlotte, N. Y., on Lake Ontario; at Cleveland, Ohio, and Erie, Pa., on Lake Erie; and at Milwaukee, Wis., and Escanaba, Mich., on Lake Michigan. By reason of ice and snow no observations were made at Escanaba during the months of January, February, March, and April of 1888. Observations were also made at Sand Beach, Mich., on Lake Huron, and at Marquette and Sault Ste. Marie, Mich., on Lake Superior. At the last-named place the observations are from June 1, 1887, to May 31, 1888.

Monthly mean of water-levels for the several stations (in feet) below the planes of reference adopted in 1876.

Stations.	1887.							1888.					
	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.
Charlotte	......	1.34	1.83	2.43	2.91	3.40	3.55	3.67	3.86	3.04	3.14	2.98	2.88
Erie	......	1.42	1.90	2.14	2.37	2.75	2.74	2.84	3.33	3.24	2.58	2.41	3.11
Cleveland	......	1.27	1.59	1.82	2.41	2.68	2.66	2.84	3.11	3.01	2.38	2.18	2.00
Milwaukee	......	1.919	2.060	2.404	2.855	3.181	3.307	3.487	3.529	3.348	3.139	2.750	2.490
Escanaba	......	2.074	2.381	2.629	3.006	3.165	3.784	......	......	......	......	2.972	2.776
Sand Beach	......	1.88	2.09	2.44	2.67	3.11	3.40	3.51	3.60	3.41	3.29	2.85	2.55
Marquette	......	3.070	2.980	3.133	3.204	3.443	3.657	3.773	3.756	3.833	3.833	3.362	2.575
Sault Ste. Marie	3.317	2.947	3.064	3.205	3.031	3.260	3.665	3.815	4.166	4.115	4.125	3.524	......

The practice has obtained of publishing diagrams showing the monthly means of water-levels at the end of each period of five years. Such a diagram was published in the Annual Report for last year. With the Report for this year are presented consolidated tabulated records of mean monthly water-levels for the different lakes for each year for which such records are complete, so far as the files of this department furnish the information. These tabulations show also the yearly mean water-levels for each year therein and the mean levels for the entire periods included in the tabulations.

A sheet of diagrams to illustrate the mean yearly oscillations of the different lakes accompanies these tabulations.

Mean monthly water-level below plane of reference for Lake Superior.

[Place of observation: Superior.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
1862 ..	3.02	3.21	3.18	3.12	2.44	2.45	2.48	2.31	2.19	2.26	2.59	2.86	2.6
1863 ..	3.05	3.18	3.35	3.31	3.18	3.26	3.12	2.50	2.48	2.65	3.00	3.11	2.6
1864 ..	3.40	3.61	3.54	3.52	3.36	3.21	3.12	3.11	2.96	3.22	3.41	3.56	3.3
1865 ..	3.74	3.75	3.88	3.44	2.95	2.54	2.22	2.14	2.13	2.34	2.87	3.18	2.9
1866 ..	3.47	3.68	3.68	3.23	2.98	2.79	2.50	2.27	2.54	2.52	2.85	2.74	2.9
1867 ..	3.01	3.12	3.31	3.09	3.09	2.49	2.16	2.28	2.20	2.22	2.65	2.97	2.7
1868 ..	3.13	3.72	3.86	3.17	2.77	2.86	2.64	2.72	2.59	2.62	2.46	2.89	2.9
1869 ..	3.11	3.35	3.80	3.22	2.82	2.81	2.44	1.98	1.13	1.65	1.99	2.64	2.3
1870 ..	2.89	3.10	3.09	2.99	2.66	2.85	2.66	2.66	2.49	2.65	2.83	3.76	2.8
1871 ..	3.85	4.45	4.03	3.33	3.00	2.88	2.81	2.75	2.65	2.72	2.79	3.53	3.2

[Place of observation: Sault Ste. Marie.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
1872 ..	3.81	3.90	4.13	4.18	3.29	3.11	2.72	2.39	2.33	2.48	2.62	3.08	3.17
1873 ..	3.47	3.65	3.62	3.61	3.05	2.85	2.35	2.15	2.09	2.25	2.83	2.64	2.7
1874 ..	3.29	3.45	3.56	3.68	3.15	2.88	2.45	2.40	2.41	2.28	2.41	2.61	2.4
1875 ..	3.06	3.31	3.36	3.11	2.80	2.52	2.41	2.40	2.12	2.25	2.53	3.09	2.73
1876 ..	3.12	3.17	3.37	3.39	2.65	2.01	1.61	1.57	1.53	1.87	2.15	2.63	2.4
1877 ..	2.92	2.90	3.01	3.14	3.20	2.91	2.58	2.47	2.71	2.67	2.91	3.07	2.9
1878 ..	3.29	3.55	3.64	3.66	3.61	3.13	3.02	3.06	3.35	3.23	3.32	3.54	3.3
1879 ..	3.94	4.84	4.58	4.45	4.08	3.93	3.70	3.61	3.69	3.66	3.84	4.24	4.01
1880 ..	4.43	4.47	4.56	4.53	3.84	3.03	2.80	2.93	2.77	2.99	2.97	3.24	3.5
1881 ..	3.56	3.66	3.63	3.75	3.32	3.09	2.89	2.97	2.79	2.32	2.43	2.81	3.10
1882 ..	3.29	3.49	3.59	3.63	3.24	3.14	2.80	2.71	2.79	2.86	2.92	3.21	3.14
1883 ..	3.61	3.72	3.70	3.64	3.63	3.29	3.09	2.74	3.02	3.18	3.33	3.53	3.37
1884 ..	3.65	3.68	3.80	4.08	3.61	3.62	3.38	3.34	3.28	3.19	3.14	3.33	3.51
1885 ..	3.54	3.63	3.76	3.94	3.39	3.02	2.84	2.63	2.88	3.03	3.11	3.41	3.27
1886 ..	3.75	3.92	3.92	3.94	3.46	3.30	3.11	2.96	3.13	3.15	3.16	3.57	3.45
1887 ..	3.82	3.92	3.99	4.12	3.76	3.317	2.947	3.064	3.205	3.031	3.260	3.065	3.50
Total.	89.22	93.93	95.44	93.47	83.34	77.237	70.847	68.114	67.455	69.291	73.870	82.905	965.11
Mean	3.43	3.61	3.67	3.59	3.21	2.97	2.721	2.620	2.594	2.665	2.841	3.189	3.0

Mean monthly water-level below plane of reference for Lakes Michigan and Huron.

[Place of observation: Point Aux Barques.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
1860..	2.02	2.07	1.93	1.96	1.91	1.67	1.58	1.66	1.85	2.23	2.35	2.65	1.9
1861..	2.86	2.82	2.68	2.48	1.86	1.52	1.40	1.29	1.37	1.59	1.90	2.03	1.9
1862..	2.41	2.42	2.51	2.30	1.93	1.81	1.76	1.78	2.00	1.72	2.04	2.33	2.0
1863..	2.49	2.64	2.69	2.62	2.30	2.17	2.26	2.25	2.39	2.65	2.60	2.92	2.5

[Place of observation: Port Austin.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
1873..	4.25	4.28	4.21	3.80	3.30	2.90	2.70	2.69	2.86	2.89	2.90	3.15	3.34
1874..	3.13	2.99	2.85	3.00	2.95	2.61	2.45	2.56	2.72	2.96	3.23	3.48	2.81

[Place of observation: Sand Beach.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
1875..	3.69	3.75	3.71	3.52	3.17	2.86	2.67	2.70	2.66	2.85	2.96	3.23	3.15
1876..	3.11	3.13	3.00	2.72	2.12	1.63	1.19	1.25	1.36	1.76	1.91	2.10	2.11
1877..	2.39	2.40	2.47	2.39	2.22	2.26	2.08	2.18	2.45	2.59	2.64	2.69	2.4
1878..	2.79	2.96	2.79	2.86	2.46	2.29	2.25	2.85	2.64	2.68	2.82	3.02	2.6
1879..	3.32	3.56	3.60	3.57	3.44	3.30	3.26	3.39	3.47	3.71	3.83	3.85	3.5
1880..	3.80	3.86	3.87	3.86	3.46	2.97	2.66	2.77	2.88	3.24	3.36	3.56	3.3
1881..	3.69	3.30	3.29	3.27	2.95	2.78	2.63	2.80	2.96	2.71	2.58	2.75	2.9
1882..	2.90	3.13	2.99	2.77	2.60	2.37	2.23	2.17	2.29	2.52	2.77	2.92	2.6
1883..	3.12	3.17	3.13	3.12	2.55	2.13	1.65	1.45	1.77	2.10	1.99	2.10	2.3
1884..	2.29	2.44	2.40	2.09	1.87	1.81	1.73	1.85	2.20	2.04	2.39	2.65	2.15
1885..	2.38	2.47	2.47	2.36	1.96	1.67	1.61	1.46	1.56	1.79	1.98	2.18	1.9
1886..	2.18	2.11	1.92	1.63	1.30	1.21	1.37	1.52	1.70	1.83	2.10	2.42	1.77
1887..	2.59	2.40	2.19	2.28	2.08	1.96	1.88	2.09	2.44	2.67	3.11	3.40	2.6
Total.	55.41	55.90	54.70	52.60	46.43	41.92	39.36	40.21	43.57	46.48	49.64	53.43	572.6
Mean	2.92	2.94	2.88	2.77	2.44	2.21	2.07	2.12	2.29	2.45	2.61	2.81	2.5

Mean monthly water-level below plane of reference for Lakes Michigan and Huron.

[Place of observation: Milwaukee.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
860 ..	2.18	2.00	1.97	1.84	1.72	1.60	1.56	1.75	1.95	2.26	2.59	2.75	2.01
861 ..	2.86	2.77	2.38	2.28	1.86	1.70	1.57	1.33	1.64	1.76	1.99	2.16	2.03
862 ..	2.36	2.51	2.21	2.05	1.80	1.67	1.77	1.78	1.85	1.96	2.35	2.49	2.07
863 ..	2.56	2.51	2.52	2.52	2.31	2.22	2.27	2.40	2.58	2.67	3.11	2.77	2.54
864 ..	3.00	3.14	2.89	3.18	2.67	2.68	2.78	2.96	3.28	3.02	3.79	3.92	3.16
865 ..	4.13	4.04	3.87	3.38	3.22	3.18	2.75	2.73	2.85	3.09	3.65	3.96	3.40
866 ..	4.22	4.46	4.41	3.96	3.78	3.49	3.23	3.17	3.32	3.43	3.52	3.78	3.73
867 ..	3.80	3.75	3.57	3.28	3.06	2.75	2.60	2.67	2.94	3.27	3.73	4.08	3.29
868 ..	4.24	4.28	3.60	3.70	3.42	3.21	3.18	3.52	3.76	3.99	4.06	4.34	3.78
869 ..	4.44	4.37	4.63	4.26	3.93	3.40	3.02	2.76	2.87	3.28	3.35	3.68	3.66
870 ..	3.57	3.48	3.18	2.76	2.42	2.28	2.17	2.26	2.12	2.52	2.92	3.27	2.75
871 ..	3.12	3.20	2.60	2.40	2.05	2.01	1.98	2.21	2.88	3.57	3.62	4.21	2.82
872 ..	4.34	4.34	4.56	4.31	4.06	3.69	3.66	3.68	3.75	3.87	4.16	4.82	4.10
873 ..	4.82	4.78	4.47	3.90	3.34	2.71	2.75	2.65	2.84	2.90	3.13	3.17	3.45
874 ..	3.21	2.92	2.77	2.87	2.89	2.52	2.59	2.58	2.83	3.18	3.38	3.72	2.96
875 ..	3.92	3.99	3.93	3.57	3.01	2.77	2.80	2.63	2.70	2.85	3.06	3.25	3.21
876 ..	3.30	3.10	2.77	2.57	1.95	1.54	1.20	1.27	1.32	1.90	1.80	2.27	2.08
877 ..	2.41	2.40	2.40	2.02	2.13	2.06	2.09	2.21	2.42	2.41	2.53	2.59	2.31
878 ..	2.71	2.78	2.62	2.60	2.30	2.16	2.15	2.47	2.67	2.78	2.91	3.28	2.62
879 ..	3.54	3.53	3.49	3.50	3.37	3.30	3.21	3.40	3.52	3.74	3.96	3.93	3.54
880 ..	3.89	3.98	3.94	3.77	3.43	2.80	2.67	2.64	2.94	3.28	3.60	3.77	3.40
881 ..	3.76	3.55	3.26	2.85	2.84	2.61	2.64	2.64	2.87	2.54	2.71	2.81	2.88
882 ..	3.03	3.04	2.67	2.54	2.44	2.17	2.109	1.919	2.048	2.448	2.662	2.998	2.506
883 ..	3.250	3.210	3.122	2.910	2.427	2.065	1.469	1.504	1.692	1.905	2.363	2.430	2.363
884 ..	2.655	2.544	2.293	2.113	1.898	1.743	1.890	2.042	2.294	2.288	2.648	2.679	2.258
885 ..	2.673	2.444	2.476	2.287	1.927	1.723	1.633	1.424	1.559	1.703	1.999	2.288	2.011
886 ..	2.057	2.044	1.757	1.490	1.230	1.159	1.349	1.581	1.832	1.915	2.201	2.589	1.771
887 ..	2.672	2.304	2.143	2.187	1.993	1.863	1.919	2.060	2.404	2.855	3.181	3.307	2.407
Total*	92.710	91.466	86.501	80.597	73.475	67.163	65.018	66.240	71.664	77.934	85.034	90.215	948.028
Mean*	3.311	3.267	3.089	2.878	2.624	2.399	2.322	2.364	2.559	2.783	3.037	3.222	2.821
Total†	57.856	56.406	53.191	49.367	44.865	40.473	39.648	40.280	43.944	47.344	52.234	55.205	580.813
Mean†	3.04	2.97	2.80	2.60	2.36	2.13	2.09	2.12	2.31	2.49	2.75	2.91	2.5473

* 1860–1887 inclusive.

† Excluding observations from 1864–'72, inclusive to compare with table for Lake Huron.

NOTE.—Omitting from the Milwaukee record those years not appearing in the record for Lake Huron the following results: At Milwaukee (Lake Michigan), sum of monthly totals, 580.813; mean water-level below plane of reference, 2.5474+. Lake Huron, sum of monthly totals, 579.65; mean water-level below plane of reference, 2.5423+.

Mean monthly water-level below plane of reference for Lake Erie.

[Place of observation: Cleveland.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly mean.
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
1860..	1.85	2.21	1.81	1.11	0.90	0.93	1.19	1.35	1.60	1.99	2.08	2.24	1.61
1861..	2.50	2.78	2.34	1.30	0.87	0.80	1.05	1.01	1.19	1.42	1.44	1.67	1.53
1862..	1.68	1.97	1.83	0.93	0.69	0.69	0.72	1.10	1.41	1.79	2.13	2.10	1.42
1863..	1.65	1.36	1.42	1.30	1.12	1.26	1.38	1.46	1.85	2.29	2.70	2.73	1.71
1864..	3.02	2.87	2.66	2.16	1.46	1.51	1.77	2.04	2.26	2.57	2.74	2.67	2.31
1865..	3.10	3.68	3.36	2.64	2.06	2.08	2.12	2.20	2.24	2.54	2.92	3.06	2.67
1866..	3.33	3.49	3.10	2.52	2.30	2.04	1.93	2.18	2.24	2.25	2.49	2.48	2.53
1867..	2.77	3.09	2.69	2.37	1.85	1.54	1.73	2.04	2.43	2.77	3.27	3.49	2.50
1868..	3.69	4.07	3.48	2.65	2.20	1.81	1.84	2.36	2.63	3.08	3.24	3.45	2.88
1869..	3.46	3.58	3.05	2.75	2.20	1.81	1.53	1.63	1.90	2.35	2.81	2.46	2.46
1870..	2.22	1.99	2.22	1.57	1.36	1.39	1.33	1.40	1.65	2.03	2.33	2.45	1.83
1871..	2.66	2.99	2.54	2.06	1.79	1.76	1.78	1.99	2.16	2.83	3.01	3.45	2.42
1872..	3.53	3.77	3.86	3.66	3.22	2.85	2.86	2.89	3.12	3.29	3.62	3.85	3.38
1873..	3.95	3.94	3.87	2.59	1.92	1.84	1.86	1.92	2.32	2.62	2.82	2.45	2.67
1874..	2.06	2.01	1.98	1.81	1.72	1.65	1.62	1.78	2.24	2.68	3.10	3.31	2.16
1875..	3.51	3.71	3.57	3.17	2.70	2.27	2.14	2.15	2.29	2.78	2.93	2.71	2.83
1876..	2.75	2.19	1.54	1.02	0.70	0.59	0.70	1.00	1.17	1.70	1.62	1.96	1.41
1878..	2.29	2.15	2.02	1.60	1.34	1.34	1.34	1.58	1.71	2.06	2.26	2.18	1.82
1879..	2.60	2.74	2.71	2.35	2.20	2.11	2.08	2.30	2.63	2.86	3.33	3.07	2.58
1882..	2.00	2.00	1.55	1.33	1.13	0.98	1.05	1.19	1.46	1.91	2.23	2.74	1.63
1883..	2.83	2.62	2.43	2.31	1.85	1.15	0.95	1.01	1.32	1.64	2.02	1.99	1.84
1884..	2.32	2.06	1.87	1.32	1.05	0.97	1.19	1.35	1.78	2.11	2.59	2.66	1.77
1885..	2.84	3.05	3.19	2.37	1.64	1.13	1.17	1.16	1.31	1.41	1.53	1.58	1.87
1886..	1.56	2.29	2.48	1.60	1.30	1.20	1.22	1.42	1.67	1.90	2.19	2.27	1.76
1887..	2.50	2.07	1.29	1.24	1.06	1.04	1.27	1.59	1.82	2.41	2.68	2.66	1.80
Total.	66.70	68.63	62.86	49.78	40.63	36.74	37.84	42.10	48.49	57.28	64.08	65.68	640.76
Mean.	2.67	2.74	2.51	1.99	1.63	1.47	1.51	1.68	1.94	2.29	2.56	2.63	2.14

Mean monthly water-level below plane of reference for Lake Ontario.

[Place of observation: Charlotte.]

Year.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Yearl mean
	Feet.	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*	*Feet.*
1860 ..	2.40	2.57	2.46	2.44	2.20	2.01	1.98	1.90	2.31	2.57	2.49	2.48	2.3
1861 ..	2.70	2.69	2.25	1.71	0.94	0.70	0.69	0.98	1.44	1.29	1.38	1.58	1.5
1862 ..	1.94	2.20	2.09	1.23	0.40	0.55	0.66	0.99	1.52	2.03	2.39	2.53	1.5
1863 ..	2.46	2.27	2.10	1.51	1.01	1.01	1.25	1.56	2.11	2.54	2.73	2.72	1.9
1864 ..	2.88	2.90	2.83	2.29	1.24	0.91	1.31	1.69	2.22	2.51	2.42	2.20	2.1
1865 ..	2.47	2.81	2.40	1.77	1.51	1.54	1.74	2.23	2.59	2.94	3.26	3.34	2.3
1866 ..	3.53	3.76	3.45	3.10	2.64	1.90	2.13	2.35	2.49	2.61	2.59	2.13	2.72
1867 ..	2.19	2.21	2.08	1.67	0.88	0.58	0.90	0.89	1.09	1.63	3.42	3.64	1.77
1868 ..	3.82	4.18	3.82	3.16	2.63	2.28	2.41	2.62	2.85	3.55	3.44	3.46	3.1
1869 ..	3.60	3.47	3.28	2.54	1.95	1.78	1.51	1.56	1.71	2.01	2.42	2.27	2.3
1870 ..	1.74	1.59	1.66	0.63	0.05	0.17	0.44	0.89	1.49	1.84	2.26	2.46	1.2
1871 ..	2.68	2.90	2.61	1.95	1.66	1.73	1.90	2.34	2.68	3.25	3.63	4.20	2.6
1872 ..	4.85	4.55	4.68	4.26	4.02	3.70	3.64	3.79	4.04	4.14	4.25	4.44	4.1
1873 ..	4.51	4.60	4.43	2.75	2.07	2.02	2.08	2.32	2.76	3.12	3.28	3.15	3.0
1874 ..	2.68	2.34	1.90	1.79	1.66	1.70	1.59	1.84	2.34	2.95	3.48	3.78	2.3
1875 ..	4.13	4.46	4.30	3.52	3.17	3.12	2.97	3.15	3.38	3.63	3.81	3.91	3.6
1876 ..	3.50	2.87	2.28	1.36	0.68	0.56	0.54	0.96	1.63	1.96	2.30	2.56	1.7
1877 ..	2.96	3.19	3.07	2.46	2.31	2.49	2.46	2.72	3.13	3.52	3.66	3.51	2.9
1878 ..	3.37	3.13	2.61	2.21	1.88	1.88	1.92	2.02	2.17	2.60	2.63	1.95	2.3
1879 ..	2.18	2.52	2.50	2.24	2.08	2.05	2.24	2.61	3.01	3.45	3.84	3.83	2.71
1880 ..	3.60	3.30	2.98	2.75	2.54	2.40	2.47	2.84	3.15	3.63	3.73	3.93	3.11
1881 ..	4.23	4.14	3.57	3.20	2.90	2.70	2.65	2.98	3.42	3.74	3.74	3.76	3.42
1882 ..	3.23	3.03	2.45	2.14	1.86	1.36	1.35	1.72	2.10	2.57	3.05	3.36	2.3
1883 ..	3.59	3.52	3.30	2.74	2.12	2.51	1.28	1.436	1.867	2.29	2.55	2.64	2.40
1884 ..	2.70	2.28	2.19	1.11	0.97	1.075	1.210	1.470	1.976	2.38	2.98	3.044	1.9
1885 ..	3.067	3.36	3.58	2.651	2.06	1.723	1.58	1.77	1.96	2.87	2.84	2.27	2.4
1886 ..	1.94	1.94	1.94	0.97	0.81	0.88	1.21	1.63	2.05	2.41	2.70	2.78	1.7
1887 ..	2.98	2.30	1.86	1.58	1.05	1.06	1.34	1.83	2.43	2.91	3.40	3.55	2.19
Total.	85.427	85.08	78.67	61.931	49.19	45.888	47.369	55.095	65.903	76.93	84.67	85.464	321.1
Mean.	3.051	3.04	2.81	2.212	1.76	1.621	1.692	1.968	2.354	2.75	3.024	3.052	2.4

B B B 2.

ISSUE OF PUBLISHED CHARTS OF THE NORTHERN AND NORTHWESTERN LAKES.

ANNUAL REPORT OF LIEUTENANT-COLONEL O. M. POE, CORPS OF ENGINEERS, BVT. BRIG. GEN., U. S. A., FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

UNITED STATES ENGINEER OFFICE,
Detroit, Mich., July 3, 1888.

SIR: I have the honor to transmit herewith, in duplicate, my annual report on the "issue of the published charts of the northern and northwestern lakes" for the fiscal year ending June 30, 1888.

Very respectfully, your obedient servant,

O. M. POE,
Lieut. Col. of Engineers,
Bvt. Brig. Gen., U. S. A.

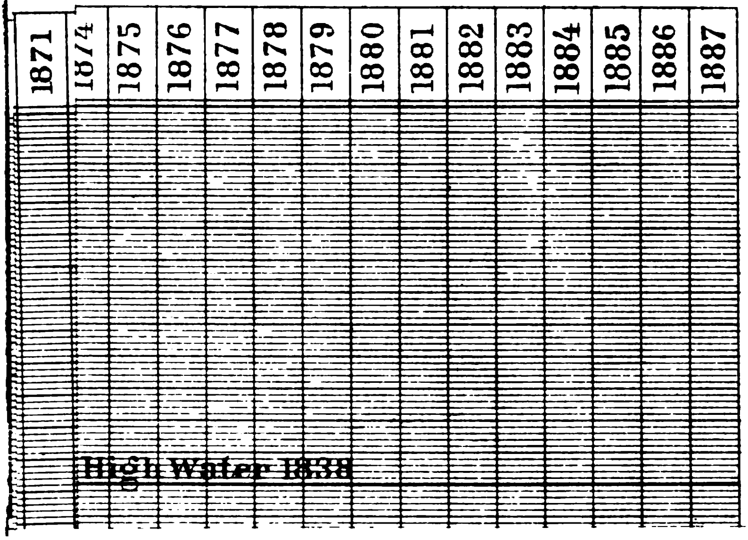
The CHIEF OF ENGINEERS, U. S. A.

ISSUE OF THE PUBLISHED CHARTS OF THE NORTHERN AND NORTHWESTERN LAKES.

The issue of the charts to registered vessels has continued during the year in accordance with regulations; also their sale at a fixed price (to cover cost of paper and printing) to all who desired to purchase.

VA VELS OF LAKE ONTARIO

uge rlotte, N.Y.



The following table shows the extent of this business:

Issue of charts of the northern and northwestern lakes during the fiscal year ending June 30, 1888.

Description.	Number.	Total.
On hand July 1, 1887	3,808	
Received during the year	11,201	
		15,009
Issued to vessels, etc	7,370	
Sold at 30 cents each	1,527	
		8,897
On hand July 1, 1888		6,112

The sum of $458.10 was turned into the Treasury from sale of 1,527 charts, at 30 cents each.

Total number of charts issued to July 1, 1887	148,831
Issued between July 1, 1887, and July 1, 1888	8,897
Total issue to July 1, 1888	157,728

Owing to changes in channels, the discovery of previously unknown dangers, and the extension of works of river and harbor improvement, many of the charts now require additions and corrections, in order to render them of the greatest service. In some cases limited surveys will be required to obtain the requisite data. Considering the extensive use made of the charts, and their recognized value to the lake marine, the sum of $10,000 should be annually appropriated for the purpose indicated, and I respectfully repeat my recommendation of last year in this respect.

The cost of printing and issuing charts is now so small that it can not be further reduced.

I therefore have the honor to submit the following:

Estimate for the fiscal year ending June 30, 1890.

For printing and issuing charts for the use of navigators, and electrotyping copper-plates for chart printing	$3,000
For minor surveys and other expenses connected with correcting and extending the charts of the northern and northwestern lakes	10,000
Total	13,000

SURVEY OF NORTHERN AND NORTHWESTERN LAKES, 1888.

Money statement.

Amount allotted from appropriation of March 3, 1887		$775.00
July 1, 1888, amount expended during fiscal year		775.00
July 1, 1888, amount available, appropriation not yet made		None.
Amount required for continuing printing and issuing charts	$3,000.00	
Amount required for minor surveys	10,000.00	
		13,000.00

APPENDIX C C C.

C C C 1.

EXPLORATIONS AND SURVEYS IN THE DIVISION OF THE MISSOURI.

ANNUAL REPORT OF CAPTAIN WILLIAM L. MARSHALL, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

UNITED STATES ENGINEER OFFICE,
Milwaukee, Wis., July 30, 1888.

SIR: I have the honor to submit my annual report as engineer officer, Division of the Missouri, for the fiscal year ending June 30, 1888, as follows:

Maj. Thomas H. Handbury, Corps of Engineers, was in charge of this office from the beginning of the fiscal year until April 5, 1888, when, in accordance with paragraph 1, Special Orders, No. 60, Headquarters of the Army, Adjutant-General's Office, Washington, D. C., March 14, 1888, he was relieved by me.

The office force has consisted of one general-service clerk, Frederick A. Petersen.

There has been no field work in progress during the year.

The office work has consisted in collecting, compiling, and platting geographical information for the improvement of existing maps; in making reductions and enlargements and fac-simile copies and tracings of maps of military and Indian reservations, posts, scouts, reconnaissances, etc., for use of these headquarters and elsewhere in the division, for file and forwarding.

During the year monthly reports of operations have been received from the engineer officers of the departments included in this division. Besides these reports, these officers are required to forward such special reports and maps of work done as may be useful to the major-general commanding the division.

A tabular statement is appended showing the number of maps received, mounted, and issued; also lists of maps and tracings drawn and miscellaneous matter.

Tabular statement of maps received, mounted, and issued.

Title of maps.	On hand June 30, 1887.	Received since.	Mounted.	Issued.
United States, showing military posts, departments, divisions, etc	8			1
Yellowstone and Missouri rivers	32			2
Western Territories	20			
Indian Territory, First Lieut. E. H. Ruffner, 1875	98			1
Indian Territory, General Land Office, 1883 and 1885	3	3	1	1
Colorado	21			
New Mexico and Arizona	28			
Territory of the United States west of the Mississippi River	11		1	2
Dakota	8			
Montana	5			
Oregon, Washington, and Idaho	6			1
Yellowstone National Park, Big Horn Mountains, and adjacent territory	123			
Yellowstone National Park, Interior Department, 1884	5			
One set of lake-survey charts	68			
One set of post-route maps	14			
Railroad map of Republic of Mexico	1			
Part of map of the Dominion of Canada	5			
Map of part of the Northwest Territory, showing telegraph lines	8			
Turkestan and countries between the British and the Russian Dominions in Asia	8			
Miscellaneous	6			
Dakota, Montana, Idaho, Wyoming, New Mexico, Utah, Arizona, and Colorado, General Land Office maps, three copies of each		24	10	8
United States and Territories, General Land Office, 1885		2		
Total	476	29	12	16

LIST OF MAPS AND TRACINGS DRAWN.

Tracing of map showing route of march from Fort Missoula to Camp on Tobacco Plains, Mont., Second Lieut. C. W. Kennedy, Third Infantry, 1887.

Tracing of the proposed route of the Duluth and Manitoba Railroad across Fort Pembina military reservation, Dak.

Tracing of a map of a proposed military reservation for Fort Du Chesne, Utah, Lieut. Daniel Cornman, Twenty-first Infantry, August, 1887.

Tracing of a plat of the Arrington ditch across Fort Lewis military reservation, Colo.

Eight copies of a sketch of the battle-ground at White River, Colorado, August 25, 1887, for Major-General Terry's annual report.

Tracing of a map of the United States military-post grounds and adjoining territory near Denver, Colo.

Tracing of a map of the United States military reservation, Fort Riley, Kans.

Tracing of a map of the United States military-post grounds at Highwood, Lake County, Ill.

Sketch of elliptic targets for rifle practice.

Plan and tracing of a proposed wharf for military post at Highwood, Lake County, Ill.

Tracing of map of the proposed water-supply and pipe-line for Fort Meade, Dak., Captain Jackson and Lieutenant Cameron, Seventh Cavalry, 1886.

Tracing of a survey of proposed boundary line between Devil's Lake Indian Agency buildings and Fort Totten military reservation, Dak., by Herman Heinze, U. S. deputy surveyor, 1887.

Tracing of a reconnaissance map of the Washita Valley from Fort Elliott, Tex., to crossing of Reno-Elliott Trail, First Lieut. G. H. Paddock, Fifth Cavalry.

Tracing of Fort McKinney military reservation, Wyo., showing irrigating ditches, October, 1887.

Two tracings of Fort Totten military reservation, Dak., showing the proposed reduction.

Tracing of map of Fort Buford military reservation, Dak., surveyed in July, 1873, by Capt. William Ludlow, Corps of Engineers.

Two tracings of "sketch of Fort Buford, Dak. Ter., and vicinity," showing modified reservation according to executive order, January 17, 1888.

Tracing of part of the post of Fort Leavenworth, Kans., showing proposed site for Roman Catholic church and school.

Second tracing of map of Fort Elliott military reservation, Tex., by George S. Storrs, State surveyor, December, 1887.

Two tracings of map showing the Rio Grande and El Paso Railroad through Fort Bliss military reservation, Tex., A. A. Robinson, February, 1888.

Sketch of route marched by Lieut. C. J. Crane, Twenty-fourth Infantry, from Fort Sill to township 2, range 16 west, and township 2, range 25 west, Indian Territory, and return, April, 1888.

Tracing showing cattle trails, etc., in the vicinity of Fort Supply and Cantonment, on North Fork of the Canadian River, Indian Territory.

MISCELLANEOUS.

Made 69 cyclostyle copies of sketch of the battle-ground at White River, Colorado, August 25, 1887, for Major-General Terry's annual report.

Made 1,178 autocopyist copies of maps showing the march of Col. J. W. Forsyth, Seventh United States Cavalry, from Fort Meade, Dak., to Fort Riley, Kans., during July, August, and September, 1887.

Mounted 101 maps.

Received from engineer officer, Department of Dakota, on August 8, 1887, a blue print of Fort Buford, Dak., military reservation and vicinity, with reservation lines resurveyed, Lieut. John Biddle, Corps of Engineers, U. S. A.

Received from engineer officer (Lieut. H. M. Chittenden, Corps of Engineers, U. S. A.) Department of the Platte, on January 31, 1888, map of Fort Niobrara military reservation, Nebr.; blue print of Bellevue Rifle Range, Nebraska; blue print of military points in vicinity of Omaha, Nebr.

Very respectfully, your obedient servant,

W. L. MARSHALL,
Captain of Engineers.

The CHIEF OF ENGINEERS,
U. S. Army.

C C C 2.

EXPLORATIONS AND SURVEYS IN THE DEPARTMENT OF THE COLUMBIA

ANNUAL REPORT OF LIEUTENANT WILLIAM C. LANGFITT, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

ENGINEER OFFICE,
HEADQUARTERS DEPARTMENT OF THE COLUMBIA,
Vancouver Barracks, Wash., July 1, 1888.

GENERAL: I have the honor to submit the following report of th operations of the engineer office at Headquarters Department of th Columbia for the fiscal year ending June 30, 1888:

PERSONNEL.

General-service clerk Alfred Downing was in this office as assistant from date of last report until April 25, 1888, when he discharged at his own request.

General-service clerk Charles A. Homan was assigned to this office June 1, 1888, and has remained since that time.

FIELD WORK.

The western boundary of the Vancouver military reservation was accurately laid down to guide the post quartermaster in removing encroaching persons. A number of roads was staked out on the Vancouver military reservation.

The depth of the artesian well bored under contract on the reservation was measured by me and the result was certified to the depot quartermaster.

An examination and report on the water supply of Fort Spokane was made to the assistant adjutant-general of this department; also a resurvey of that reservation was made with report.

Resurvey of Fort Townsend military reservation with report to assistant adjutant-general of this department.

OFFICE WORK.

Department maps issued	[illegible]
Maps and plans drawn by hand	[illegible]
Tracings for issue and office files	[illegible]
Solar prints	[illegible]
Reports of scouts, etc., referred to office for note	[illegible]
Maps mounted on linen	[illegible]
Negatives for official use	5

In addition to the above, a department map, scale 16 miles to the inch, was corrected to December, 1887, and copy forwarded through military channels to the Chief of Engineers, with request that a new issue, embodying the corrections, be made and 300 copies furnished this office. This new issue has been received, and will be issued as called for.

A map of Alaska, scale 16 miles to the inch, has been projected and compilation of available data started thereon.

Short tables of distances were compiled for the use of certain troops going in the field. Directories of the post of Vancouver Barracks have been kept corrected to date and copies furnished to officers from time to time.

Standard (one hundred and twentieth meridian) time has been furnished to the post by signal from this office throughout the year.

Two reports have been made from this office to the Chief of Engineers, U. S. Army, viz: One as to whether the "Taxsas road" in this Territory is a "military road" or not, and one on a military wagon road between Cape Foulweather, in Benton County, and Coos Bay, in Coos County, Oregon.

In addition to the above, many reports on different subjects have been made to the assistant adjutant-general, Headquarters Department of the Columbia, and other miscellaneous work done.

There have been no funds available in this office during the year.

The quartermaster's department has kindly furnished such materials as were necessary to carrying on the work of this office.

Very respectfully, your obedient servant,

WM. C. LANGFITT,
First Lieut., Corps of Engineers,
Engineer Officer.

The CHIEF OF ENGINEERS,
U. S. Army.

C C C 3.

EXPLORATIONS AND SURVEYS IN THE DIVISION OF THE PACIFIC.

ANNUAL REPORT OF LIEUTENANT JAMES E. RUNCIE, FIRST ARTILLERY, FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

ENGINEER OFFICE,
HEADQUARTERS DIVISION OF THE PACIFIC,
San Francisco, Cal., July 7, 1888.

SIR: I have the honor to transmit herewith my report of operations for the fiscal year ending June 30, 1888.

First Lieut. Thomas L. Casey, Corps of Engineers, who was on duty here at the commencement of the present fiscal year, was relieved by paragraph 2, Special Orders, Division of the Pacific, No. 61, dated September 19, 1887, in compliance with paragraph 10, Special Orders, No. 211, 1887, Headquarters of the Army, Adjutant-General's Office, Washington.

Capt. Daniel D. Wheeler, assistant quartermaster, then assumed charge of the office under paragraph 3, Special Orders, Division of the Pacific, No. 61, September 19, 1887.

By virtue of General Orders, No. 2, Headquarters Division of the Pacific, March 3, 1888 (under authority of the Secretary of War), I took charge of the office.

Assistant Clement Winstanley has been continually on duty as topographer and draughtsman throughout the year, but in September, 1887, was detailed as clerk to the inspector of rifle practice for the Department of California, which occupies nearly the whole of his time during the target season, leaving all draughting at a complete standstill; in consequence, not so much work has been accomplished as I should wish.

The office work has consisted of the following:

Made map of portion of California south of Mojave Junction.

Corrected land office map of California.

Made drawings of plant, machinery used in the manufacture of high explosives, and the acids necessary to their preparation, from sketches made by Lieut. E. St. J. Greble, Second Artillery, aid-de-Camp.

Calculated projection for the map of the Department of Arizona and the District of New Mexico.

Collected further data for correcting existing maps of the division.

Drew and graduated numerous arcs of 100 degrees for use in sea-coast gun firing at Presidio.

Collected data, corrected and compiled map of Fort McDermit, Nev., and Fort Bidwell, Cal., as recommended by the Inspector-General.

First Lieut. Thomas L. Casey, Corps of Engineers, in compliance with paragraph 2, Special Orders, No. 66, Headquarters Department of California, August 24, 1887, proceeded at Fort Gaston, Cal., where he made surveys for a new water supply to the post; also for a military telegraph line from the fort to Arcata, Humboldt County, Cal., and submitted reports thereon.

First Lieut. James E. Runcie (by paragraph 4, Special Orders, No. 61, Headquarters Division of the Pacific, September 19, 1887) accompanied by Assistant C. Winstanley (paragraph 3, Special Orders, No. 63, Headquarters Division of the Pacific, September 30, 1887), proceeded to Fort Huachuca, Ariz., where a detailed survey for contours was made of the vicinity of the post, with a view to perfecting a system of sewerage, on which an exhaustive report was rendered and drawings made in this office to illustrate same; of which tracings numerous blue prints were made.

Calculated and laid out projection of new map of the Department of California by order of the assistant adjutant-general. About one fourth of this map is completed.

A few maps have been mounted for officers of the division staff.

Surveyed and leveled line of proposed road on the Presidio reservation.

Very respectfully, your obedient servant,

J. E. RUNCIE,
First Lieut. First Artillery,
Acting Engineer Officer.

The CHIEF OF ENGINEERS, U. S. A.

C C C 4.

EXPLORATIONS AND SURVEYS IN THE DEPARTMENT OF THE PLATTE.

ANNUAL REPORT OF LIEUTENANT HIRAM M. CHITTENDEN, CORPS OF ENGINEERS, FOR THE FISCAL YEAR ENDING JUNE 30, 1888.

HEADQUARTERS DEPARTMENT OF THE PLATTE,
ENGINEER OFFICE,
Omaha, Nebr., June 30, 1888.

GENERAL: I have the honor to submit the following report of operations for the year ending June 30, 1888:

I reported for duty to the commanding general at these headquarters on the 16th of July, 1887, in compliance with paragraph 4, Special Orders No. 151, current series 1887, headquarters of the Army.

On August 10, 1887, I went to Fort Niobrara, Nebr., in compliance with Special Orders No. 69, headquarters Department of the Platte and surveyed, relocated, and marked the boundaries of that reservation. I returned from this duty September 11, 1887.

On November 15, 1887, I went to Bellevue Rifle Range, Nebraska, in compliance with Special Orders No. 115 of these headquarters, and surveyed the range, returning the same day.

On May 4, 1888, I went to Cheyenne, Wyoming, in compliance with paragraph 1, Special Orders No. 31, current series, headquarters Department of the Platte, and made transcripts of the records of the land office of Wyoming Territory, returning May 11, 1888.

On May 16, 1888, I went to Fort Bridger, Wyoming, in compliance with paragraph 2, Special Orders 37, current series, headquarters Department of the Platte, to superintend the laying of a system of waterworks at that post. I returned from that duty June 26, 1888.

The above includes all field work or work outside the office during the year.

The office work during the year has been as follows:

Maps of the Fort Niobrara military reservation and of the Bellevue Rifle Range have been prepared; also a plat showing collectively all the military posts and reservations in the department.

All the spare time during the year has been put upon a map of a part of the Department of the Platte, which is now well under way. In this work I have found the greatest difficulty in getting reliable information, but have spared no pains to settle correctly all disputed points. The map when complete will not be strictly one of this department, but will include that territory lying between 102° and 114° west longitude, and 39° and 46° north latitude. This includes nearly all the military posts in the Department of the Platte, as well as several in adjoining departments. It also includes all principal places and railroads in the territory of which Wyoming is the center, and for a hundred miles around it. The map will be completed as early as possible, but, owing to the large amount of work outside the office during the present summer, will probably not be completed before the end of this year.

I have received from the Engineer Department at Willets Point several instruments which have been placed upon my return. They will be of much use during the present season.

There has been the usual office routine work of issuing instruments, maps, etc., to the officers and posts of the department.

Very respectfully, your obedient servant,

H. M. CHITTENDEN,
First Lieutenant Corps of Engineers,
Engineer Officer of Department.

The CHIEF OF ENGINEERS,
U. S. Army.

LAWS

AFFECTING

THE CORPS OF ENGINEERS,

UNITED STATES ARMY,

FIFTIETH CONGRESS, FIRST SESSION.

1887-'88.

2821

LAWS

AFFECTING

THE CORPS OF ENGINEERS, UNITED STATES ARMY.

FIFTIETH CONGRESS, FIRST SESSION, 1887–'88.

ACTS.

AN ACT to authorize the construction of a railroad, wagon, and foot-passenger bridge across the Mississippi River, at or near Burlington, Iowa.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Burlington and Illinois Bridge Company, its successors, and assigns, be, and they are hereby, authorized to construct and maintain, if in the opinion of the Secretary of War the same be a public necessity, a railroad, wagon, and foot-passenger bridge across the Mississippi River at a place suitable to the interests of navigation at a point at or near the city of Burlington, Iowa, and to lay on or over said bridge a track or tracks for the more perfect connection of any railroad or railroads that are or shall be constructed to said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided; that said bridge shall not interfere with the free navigation of said river beyond what is necessary in order to carry into effect the rights and privileges hereby granted; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, the cause may be tried before the circuit court of the United States in and for any district in which any portion of said bridge or obstruction touches. Said bridge shall be constructed to provide for the passage of railroad trains, and for the safe and convenient passage of wagons and vehicles of all kinds, animals, and foot-passengers, for such reasonable rates of toll as may be fixed from time to time by the Secretary of War: *Provided,* That the proviso regarding wagons, animals, foot-passengers, and so forth, shall not influence the location of said bridge in its relation to the interests of navigation.

SEC. 2. That any bridge built under the provisions of this act may, at the option of the company building the same, be built as a draw-bridge or with unbroken and continuous spans: *Provided,* That if the said bridge shall be made with unbroken and continuous spans, it shall give clear head-room of not less, in any case, than fifty-five and one-half feet above extreme high-water mark, as understood at the point of location, nor shall the spans of said bridge give a clear width of water-way of less than two hundred and fifty feet, and the piers of said bridge shall be parallel with the current of said river, and the main span shall be over the main channel of the river and give a clear width of water-way of not less than three hundred feet: *And provided further,* That if any bridge built under the provisions of this act shall be constructed as a draw-bridge, the same shall be constructed as a pivot draw-bridge, with a pivot over the main channel of the river at an accessible and navigable point and with spans giving a clear width of water-way of not less than two hundred feet on each side of the central or pivot pier of the draw, and the next adjoining span or spans to the draw shall give a clear width of water-way of not less than two hundred and fifty feet: *Provided,* That if the pivot pier of said bridge shall be constructed within less than four hundred and ten feet of the west shore of said river the span constructed west of said pivot pier may be less than two hundred and fifty feet, and said spans shall give a clear head-room of not less than ten feet above extreme high-water mark; and the piers of said bridge shall be parallel with the current of the river where said bridge shall be erected: *And provided also,* That said draw shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over the draw; but in no case shall unnecessary delay occur in opening the said draw during or after the passage of trains.

SEC. 3. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, and for passengers or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads and public highways leading to said bridge; and the United States shall have the right of way for postal telegraph purposes across said bridge.

SEC. 4. That all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passages of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties, in case they shall not agree.

SEC. 5. That the structure herein authorized shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-line at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any bridge or bridges, and shall furnish such other information as shall be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are decided by the Secretary of War to be such as will not materially affect the interests of navigation, the bridge shall not be commenced or built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and the said bridge shall be constructed with such aids to the passage of said bridge, in the form of booms, dikes, piers, or other suitable and proper structures for confining the flow of water to a permanent and easily navigated channel, for a distance of not less than one mile above the bridge location, and for the guiding of rafts, steamboats, and other water-craft, safely through the draw and raft spans, as the Secretary of War shall prescribe and order to be constructed and maintained at the expense of the company owning said bridge; and the said structure shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through or under said structure; and for the safety of vessels passing at night there shall be displayed on said bridge, from the hours of sunset to sunrise, such lights as may be prescribed by the Secretary of War: and the said structure shall be changed or removed at the cost and expense of the owners thereof from time to time, as Congress may direct, so as to preserve the free and convenient navigation of said river: and the authority to erect and continue said bridge shall be subject to revocation and modification by law, when the public good shall, in the judgment of Congress, so require, without any expense or charge to the United States.

SEC. 6. That if actual construction of the bridge herein authorized shall not be commenced within two years from the passage of this act, and be completed in four years from the same date, the rights and privileges hereby granted shall cease and be determined.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, January 31, 1888.

AN ACT making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, eighteen hundred and eighty-seven, and for prior years, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year eighteen hundred and eighty-seven, and for other objects hereinafter stated, namely:

WAR DEPARTMENT.

To enable the Secretary of War to pay to Chittenden Brothers, contractors, for money expended in the construction of a dam at the Great Falls of the Potomac over and above that contemplated in the contract with said Chittenden Brothers, as amended, the sum of fifteen thousand dollars, payable from any unexpended balance of money appropriated for the construction of such dam.

To pay D. M. and C. P. Dull the amount ascertained by the Secretary of War to be due them for work done on the Great Kanawha River, West Virginia, and by reason of changes in their contract, and so forth, thirty-four thousand three hundred and seventy-nine dollars and thirty cents.

To pay Charles McCafferty the amount ascertained by the Secretary of War to be due him for work on the Great Kanawha River, West Virginia, and by reason of changes in his contract, and so forth, thirty thousand three hundred and seventy dollars and fifteen cents: *Provided*, That any contract indebtedness of said McCafferty incurred by subcontract, or for labor or material furnished for the prosecution of the work on which this sum is based, shall be first ascertained and paid by the Secretary of War and the balance paid to said McCafferty. Said amounts shall be received in full satisfaction of all claim under said contract.

* * * * * *

Approved, February 1, 1888.

AN ACT authorizing the construction of a bridge across the Missouri River at some accessible point in the County of Saint Charles in the State of Missouri, below the city of Saint Charles.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Saint Louis, Keokuk and Northwestern Railroad Company, an incorporation organized under the laws of the State of Iowa, and owning and operating a railroad in the State of Missouri, its assigns or successors, is hereby authorized to construct and maintain a bridge across the Missouri River at such point as may be hereafter selected by said corporation between the City of Saint Charles and the mouth of the Missouri River, in the County of Saint Charles, in the State of Missouri, as shall best promote the public convenience and welfare and the necessities of business and commerce, and also to construct accessory works to secure the best practicable channel-way for navigation and confine the flow of the water to a permanent channel at such point, and to lay on and over said bridge one or more railroad tracks for the more perfect connection of any railroads that are or shall be constructed to said river at or opposite said point.

SEC. 2. That said bridge shall be constructed and built without interference with the security and convenience of navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines to high and low water, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built: *Provided*, That if the said bridge shall be made with unbroken and continuous spans, it shall have three or more channel spans, and shall not be of less elevation in any case than fifty feet above high water mark, as understood at the point of location, to the lowest part of the superstructure, nor shall the spans of said bridge be less than three hundred feet in length, and the piers of said bridge shall be parallel with the current of said river, and the main span shall be over the main channel of the river, and not less than three hundred feet in length: *And provided also*, That if any bridge built under this act shall be constructed as a draw-bridge, the same shall be constructed as a pivot draw-bridge, with a draw over the main channel of the river at an accessible and navigable point, and with spans of not less than one hundred and sixty feet in length in the clear on each side of the central or pivot pier of the draw, and the next adjoining span or spans to the draw shall not be less than three hundred feet, and the head-room under such span shall not be less than ten feet above high-water mark: *Provided also*, That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe: *Provided also*, That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties.

SEC. 3. That the Secretary of War is hereby authorized and directed, upon receiving such plan and map and other information, and upon being satisfied that a bridge built on such plan and with such accessory works and at such locality will conform to the prescribed conditions of this act, to notify the company that he approves the same; and upon receiving such notification the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location; and should any change be made in the plan of the bridge of said accessory works, during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War, and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States of the eastern district of the State of Missouri, in whose jurisdiction any portion of said obstruction or bridge may be located.

SEC. 4. That the said bridge and accessory works, when built and constructed under this act and according to the terms and limitations thereof, shall be lawful structures; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States.

SEC. 5. That the United States shall have the right of way for such postal and telegraph lines across said bridge as the Government may construct or control.

SEC. 6. That Congress shall have power at any time to alter, amend, or repeal this act, so as to prevent or remove all material and substantial obstructions to the navigation of said river by the construction of said bridge and its accessory works; and all alterations of said bridge shall be made and all such obstructions shall be removed at the expense of the owners of or persons controlling such bridge: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in refereuce to the protection of the navigation of rivers or to exempt this bridge from the operation of the same.

Approved, February 17, 1888.

AN ACT to authorize the construction of a bridge over the Missouri River, at or near the city of Lexington, Missouri.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Lexington Bridge Company, a corporation existing under the laws of the State of Missouri, be, and is hereby, authorized to construct, operate, and maintain a bridge over the Missouri River at or near the city of Lexington, in said State of Missouri. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the persons by whom it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War; and in case of any litigation concerning any alleged obstruction to the free navigation of said river on account of said bridge, the cause may be tried before the circuit court of the United States in whose jurisdiction any portion of said obstruction or bridge is located.

SEC. 2. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for their transportation over the railroads or public highways leading to said bridge; and the United States shall have the right of way for postal telegraph and telephone purposes across said bridge.

SEC. 3. That if said bridge shall be made with unbroken and continuous spans, it shall not be of less elevation in any case than fifty feet above highwater mark as understood at the point of location, to the lowest member of the bridge superstructure, nor shall the spans of said bridge over the main channel of said river be less than three hundred and fifty feet in length, and the piers of said bridge shall be parallel with the current of said river, and the bridge itself at right angles thereto: *Provided*, That if said bridge be constructed as a draw-bridge, it shall be constructed as a pivot draw-bridge, with a draw over the main channel of the river at an accessible and the best navigable point, and with spans of not less than two hundred feet in length in the clear on each side of the central or pivot pier of the draw; and said spans shall not be less than ten feet above low-water mark, measuring to the lowest member of the bridge superstructure: *And provided also*, That said draw shall be opened promptly, upon reasonable signal, except when trains are passing over the said bridge, for the passage of the boats whose construction shall not be such as to admit of their passage under the draw of said bridge when closed; but in no case shall unnecessary delay occur in opening the said draw after the passage of trains; and the said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

Sec. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

Sec. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and if said bridge is not commenced within one year and completed within three years from the passage of this act, the rights and privileges hereby granted shall be null and void.

Sec. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure or its entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

Approved, February 18, 1888.

AN ACT to authorize the removal of the quarantine station from Ship Island, Mississippi.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury is hereby authorized to cause the removal of the national quarantine station now located on Ship Island, in the Gulf of Mexico, to some other island in said Gulf, or in such pass in the Mississippi Delta as may be recommended by a board to be designated by him, and that the necessary quarantine buildings and appliances be established thereon; and that the sum of forty-five thousand dollars, or so much thereof as may be necessary, is hereby appropriated to carry out the purposes of this act.

Approved, March 5, 1888.

AN ACT to provide for certain of the most urgent deficiencies in the appropriations for the service of the Government for the fiscal year ending June thirtieth, eighteen hundred and eighty-eight, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums, or so much thereof as may be necessary, be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the objects hereinafter expressed, for the service of the fiscal year ending June thirtieth, eighteen hundred and eighty-eight, and prior years, namely:

* * * * * * *

DISTRICT OF COLUMBIA.

* * * * * * *

Increase of water-supply, Washington, District of Columbia: To enable the Secretary of War to complete the work of increasing the water-supply of the city of Washington, under the act entitled "An act to increase the water-supply of the city of Washington, and for other purposes," approved July fifteenth, eighteen hund and eighty-two, namely: For completion of lining of the tunnel, two hundred a ninety-seven thousand seven hundred and fifty dollars; for completing shafts, w connection, and for superintendence and engineering, thirty-seven thousand two hu dred and fifty dollars; and for general contingencies of the work, twenty thous dollars; in all, three hundred and fifty-five thousand dollars; all of said work to completed by November first, eighteen hundred and eighty-eight; said sum to be su ject to all the provisions and restrictions of the said act of July fifteeth, eighteen hu dred and eighty-two, and of the act approved July fifth, eighteen hundred and eigh four, making appropriations for the expenses of the government of the District of C lumbia, as to its apportionment and settlement between the United States and t District of Columbia, and the refunding thereof. The work above provided for to done under the contract heretofore made or by a reletting, as in the discretion of t Secretary of War shall be most promotive of the interest of the Government: *Pr vided*, That no contract shall be made at prices greater than the prices allowed un contract under which work has been heretofore done on said tunnel.

WAR DEPARTMENT.

* * * * * *

ENGINEER DEPARTMENT.

EXAMINATIONS AND SURVEYS AT SOUTH PASS, MISSISSIPPI RIVER: Annual expe of ascertaining the depth of water and width of channel secured and maintained fr time to time at South Pass of the Mississippi River, to enable the Secretary of Wa report to Congress during the maintenance of the work, as required by Congre eight thousand eight hundred dollars.

* * * * * * *

Approved, March 30, 1888.

AN ACT to correct an error in and to further amend "An act to authorize the Georgia Pacific R road Company to construct bridges across the Sunflower, Yazoo, and Tombigbee Rivers, in Mis sippi," approved March third, eighteen hundred and eighty-seven.

Whereas by reason of a clerical error in the copying of the draft of a bill to be e titled "An act to authorize the Georgia Pacific Railway Company to construct bridg across the Sunflower, Yazoo, and Tombigbee Rivers, in Mississippi," approved Mar third, eighteen hundred and eighty-seven, the title of the said act, and the enacti clauses thereof, names the Georgia Pacific Railroad Company as the beneficiary of t said act, and the corporation upon whom the rights, powers, and privileges there recited are conferred; and

Whereas no corporation of that name exists, and it was intended that the sa rights, powers, and privileges should be conferred, not upon the Georgia Pacific Ra road Company, but upon the Georgia Pacific Railway Company, a corporation creat and existing under and by virtue of the laws of the States of Alabama and Missi sippi; and

Whereas the said Georgia Pacific Railway Company is the true and only beneficia of said act, and since the passage thereof, has been using all the means in its pow to complete its plans for the location and construction of bridges across the riv named in said act, in accordance with the recommendations and approval of the Se retary of War and the Chief of Engineers of the United States Army, and as requir by the laws of the United States; and

Whereas by section three of said act it is provided that if said bridges shall not b finished within two years from the passage thereof, the rights and privileges thereb granted shall be null and void; and

Whereas it will be impossible to complete the plans, location, and construction o said bridges within two years from the passage of said act, as provided therein Therefore,

Be it enacted by the Senate and House of Representatives of the United States of Ameri in Congress assembled, That the act entitled "An act to authorize the Georgia Pacif Railroad Company to construct bridges across the Sunflower, Yazoo, and Tombigb Rivers, in Mississippi," approved March third, eighteen hundred and eighty-seve be, and is hereby, amended by striking from the title and enacting clauses thereo the word "railroad," wherever it occurs in the statement of the name of the corpora tion therein mentioned, and inserting, in lieu thereof, the word "railway," so as t make the corporate name of said corporation read, "The Georgia Pacific Railwa Company," instead of "The Georgia Pacific Railroad Company."

And by striking out the words "two years from the passage of this act," where ey occur in the final clause of section three of the act, and inserting the words four years from March third, eighteen hundred and eighty-seven," in lieu thereof, as to make said final clause read as follows: "And if said bridges shall not be ished within four years from March third, eighteen hundred and eighty-seven, e rights and privileges hereby granted shall be null and void."

Approved, April 2, 1888.

AN ACT regulating the construction of bridges over the Muskingum River, in Ohio.

Be it enacted by the Senate and House of Representatives of the United States of America Congress assembled, That any person or corporation having lawful authority to erect bridge or bridges across the Muskingum River, Ohio, between its mouth and Dres- n, may hereafter erect bridges across said river for railroad or other uses upon mpliance with the provisions and requirements of this act, but no bridge shall be ected across said river which does not comply therewith.

SEC. 2. That every bridge hereafter erected across the Muskingum River, Ohio, all have its axis at right angles to the current at medium and high stages, and its ers shall be parallel to this current. No riprap or other outside protection for in- fficient foundations will be permitted around the channel piers, and all coffer-dams, iling, and other temporary works must be removed by the owners of the bridge be- re it is open to traffic. Every such bridge may be built either as a draw-bridge or as continuous bridge; If built as a draw-bridge, the draw span shall give two clear penings, measured on the low water line. of eighty-feet, and smooth crib work or asonry shall be built at right angles to the bridge extending up stream from the ivot pier, a distance of at least one hundred feet, and down stream the same dis- ance, and the height of this protection pier shall not be less than four feet above ighest locking stage. The channel sides of the channel piers shall be smoothly cut; e corners of the draw piers shall be rounded to a radius of not less than six inches; ere shall be no projecting cornices on the piers, nor projecting footway on the draw pan; the apparatus for swinging the draw shall be sufficient to open it in not more an five minutes; and the draw shall be promptly opened on signal. The location f the draw span shall be subject to the approval of the Secretary of War.

SEC. 3. That if the bridge be built as a continuous bridge it shall have at least one annel span, the center of which shall be in the middle of the channel usually run high stages by steamboats descending the river with barges or rafts in tow; said hannel span to have a clear opening of two hundred and fifty feet, measured at the w-water line, and the lowest part of the span to be forty feet above highest navi- able water, as determined by a straight line connecting the tops of the lower lock ates at the head and foot of the pool in which the bridge is to be built. The other pans may have such grades as may be desired.

SEC. 4. That whenever any duly authorized persons or corporations shall deter- ine to apply to the Secretary of War for permission to build a bridge across the uskingum River, they shall first give public notice of said intention by publication, nce a week for four weeks, in newspapers having a wide circulation, in not less than wo newspapers published in towns on the Muskingum River below Dresden, and in ot less than two newspapers published in Pittsburgh. They shall also submit to the ecretary of War, for his examination and approval, a design and drawing of the ridge and piers, and a map of the locality, on the scale of one inch to one hundred eet, giving, for the space of one-quarter of a mile above and one-quarter of a mile elow the site of the proposed bridge, the topography of the banks of the river, the ne of low and highest navigable water, an accurate representation of the bed of e river by contour lines, two feet apart, determined by accurate soundings; and hall also show over the whole width of this part of the river, the force and direc- on of the currents at low water, and at high navigable stages, by triangulated ob- ervations on suitable floats. The map shall also show the location of all bridges, cks, and dams, coal tipples, breakwaters, and others structures within the high- ater lines in the designated area. Said map and drawings shall be referred to board of engineer officers or to the engineer officer in charge of the Muskingum iver for examination and report; and said board, or officer, shall visit the site of the roposed bridge and shall hold a public session at some convenient point, of which ublic session due notice and invitation to be present shall be given to all interested arties; and if said board, or officer, shall report the site as unfavorable, the Secre- ary of War, is authorized to require that such changes be made in the proposed ridge by lengthening the spans, or by the addition of guiding dikes or other auxil- ary works, or by both, or by increasing the height, or by such other modifications as ill make the bridge as safe for navigation as if built in a favorable part of the river; nd no bridge shall be begun until the plans have been approved by the Secretary f War.

SEC. 5. That in case the location of the proposed bridge crosses the river at the side one of the lateral canals, and the main bridge is over a part of the river that is navigable, the provisions of the foregoing sections are so far modified that the protection piers above and below the pivot-pier of the draw may be replaced by piling or similar approved construction, and in case of a continuous bridge, the span over a canal need not exceed the width of the canal measured between the tops of its banks. The current observation may also be omitted.

SEC. 6. That all parties owning, occupying, or operating bridges over the Muskingum River shall maintain for the security of navigation, at their own expense, from sunset to sunrise, throughout the year, such lights on their bridges, as may be required by the Light-House Board, or the United States engineer officer in charge of said river, and during the construction of any bridge under this act such lights and buoys shall be kept on coffer-dams, cribs, piling, floating crafts, rafts, and so forth used in the construction of the bridge, as may be necessary for the security of navigation.

SEC. 7. That the officers and crews of all vessels, boats, or rafts navigating the Muskingum River, shall be required to regulate the use of said vessels, and of any pipes or chimneys belonging thereto, so as not to interfere with the construction of any of the bridges authorized by the provisions of this act.

SEC. 8. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, over which no higher charge shall be made for the transmission over the same of the mails the troops, and the munitions of war of the United States than the rate per mile paid for transportation over the railroads or public highways leading to the said bridge; and the United States shall have the right of way for telegraph or telephone purposes across any such bridge; and in case of any litigation arising from any alleged obstruction to the navigation of said Muskingum River created by the construction of any bridge under this act the cause or question arising may be tried before the circuit or district court of the United States for the eastern division of the southern district of Ohio.

SEC. 9. That the right to alter, amend, or repeal this act so as to prevent or remove all material obstructions to the navigation of said river by the future construction of bridges is hereby expressly reserved, without any liability of the Government for damages on account of the alterations or amendment of this act, or on account of the prevention, or requiring the removal of any such obstructions; and the entire removal of said bridge after its construction, or any change in the construction thereof or any alteration of any such bridge that may be directed, at any time by the Secretary of War, shall be made at the cost and expense of the owners thereof.

Approved, April 2, 1888.

AN ACT authorizing the Little Rock and Alexandria Railway Company to build certain bridges in the State of Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Little Rock and Alexandria Railway Company in Arkansas and Louisiana, a corporation duly and legally organized and existing under and by virtue of the laws of the said States, its successors or assigns, be, and is hereby authorized to construct and maintain a bridge, and approaches thereto, over the Ouachita River, in Union County, in the State of Arkansas near Wilmington, at the point where said company's line of railway as projected crosses said river; and a bridge, and approaches thereto, over the Saline River, in the State of Arkansas, at the point where said company's line of railway as now projected crosses said river. Said bridges shall be constructed to provide for the passage of railway trains, and at the option of said company by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War. That if the said bridges, or either of them, over the said Ouachita and Saline rivers shall be made with unbroken and continuous spans there shall be at least one span of a height of not less than eighty feet above low water and fifty feet above highest water, as understood at the point of location, measured to the lowest part of the superstructure of said bridge; and said span shall have a clear opening of at least two hundred feet between the piers, measured at right angles to the current, and shall be over the main channel of the river, and the bridge or bridges shall be at right angles to, and the piers parallel with, the current of the river. And if the bridges, or either of them, over the said Saline and Ouachita rivers, shall be constructed as draw or pivot bridges, the draw or pivot piers shall be over the main channel of the river at an accessible navigable point, and the openings on each side of the pivot-pier shall not be less than one hundred and thirty feet in the clear, unless otherwise expressly directed by the Secretary of War, and if so directed shall be according to such direction, and, as nearly as practicable, the said openings shall be accessible at all stages of water, and the spans shall not be less than ten feet above extreme high water, as understood at the point of location, to the lowest part of the superstructure of the bridge, and the piers and draw-rests shall be parallel with, and the bridge or bridges at right angles to, the current of the river or rivers; and no riprap or other outside protection for imperfect foundations shall be permitted to approach nearer than four feet to the surface of the water at its extreme low stage, or otherwise to encroach upon the channel-ways provided for in this act; and all and each of said draws shall be opened promptly upon reasonable signal for the passing of boats; and said company shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridges as the Light-House Board may prescribe.

SEC. 2. That any bridge built under this act, and subject to its limitations, shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States.

SEC. 3. That no bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said rivers; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge or bridges to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge. And in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States for the State of Arkansas, in which any portion of said obstruction or bridge may be located: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers or to exempt said bridges from the operation of the same.

SEC. 4. That all railway companies desiring the use of said bridges, or either of them, shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same and over the approaches thereto, upon payment of a reasonable compensation for such use.

SEC. 5. That the bridges authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said rivers as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of said bridges, and each of them, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge or bridges are approved by the Secretary of War the bridge or bridges shall not be built; and should any change be made in the plan of said bridges, or either of them, during the progress of construction, such change shall be subject to the approval of the Secretary of War. And the said structure shall be changed at the cost and expense of the owners thereof, from time to time, as the Secretary of War may direct, or the whole of said structure may be removed at the expense of the owners thereof, if the Secretary of War may, at any time, so direct, so as to preserve the free and convenient navigation of said rivers, and the authority to erect and continue any and all of said bridges shall be subject to revocation by law whenever the public good shall, in the judgment of the Secretary of War, so require.

SEC. 6. That this act shall be null and void if actual construction of the bridges herein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, April 4, 1888.

AN ACT to authorize the construction of bridges over the rivers Saint Mary's, Satilla, Little Satilla, and Crooked, in the States of Georgia and Florida.

Be it enacted by the Senate and House of Representatives of the United States in Congress assembled, That the Jacksonville and East Tennessee Railroad Company be, and are hereby, authorized to construct a bridge over the river Saint Mary's, in the county of Camden and State of Georgia, and in the county of Nassau and State of Florida, at the point where said railroads cross said river.

SEC. 2. That the Jacksonville and East Tennessee Railroad Company be, and is hereby, authorized to construct a bridge over the river Satilla, in the county of Camden, in the State of Georgia, at the point where said railroad crosses said river.

SEC. 3. That said bridges shall be so constructed, either by draw, span, or otherwise, so that a free and unobstructed passage may be secured to all vessels and other water-craft navigating said rivers.

SEC. 4. That the said Jacksonville and East Tennessee Railroad Company be, and is hereby, authorized to construct fixed bridges over the Little Satilla River, between the counties of Camden and Glynn, and over Crooked River, in the county of Camden, in said State of Georgia, at the points selected by said company where said railroad crosses said rivers, with one span, and to make said bridges of such height as they may see fit: *Provided*, That the height be sufficient to permit the passage of timber rafts and other vessels navigating said rivers under said bridges.

SEC. 5. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over said bridge, than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge and its approaches for said postal-telegraph purposes.

SEC. 6. That if any of the said bridges authorized to be constructed by this act shall be constructed as a draw-bridge, the draw shall be opened promptly upon reasonable signal for the passage of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge or bridges as the Light-House Board shall prescribe. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said river; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such obstructions shall be removed and alterations made at the expense of the owner or owners of said bridge: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers or to exempt this bridge erected under this act from the operation of the same.

SEC. 7. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties.

SEC. 8. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object said company or corporation shall submit to the Secretary of War a design and drawings of said bridge to be erected, for his examination and approval, and a map of its location, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and in all things shall be subject to such rules and regulations as may be prescribed by the Secretary of War; and until said plan and location of said bridge or bridges are approved by the Secretary of War said bridge or bridges shall not be built; and should any change be made in the plan of any bridge authorized to be constructed by this act, during the progress of the work of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 9. That this act shall be null and void if actual construction of the bridge therein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 10. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require any changes in said structures, or their entire removal, at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interest requires it, is also expressly reserved.

Approved, April 9, 1888.

AN ACT authorizing the construction of a bridge across the Tennessee River at Chattanooga, Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby given to the Chattanooga Bridge Company, a corporation organized under the laws of the State of Tennessee, having its principal office at Chattanooga, in said State, and to its successors or assigns, to build, construct, and maintain a bridge, as hereinafter described, across the Tennessee River at Chattanooga, in the State of Tennessee, the southern terminus of said bridge to be at some point between the west line of Market street and the east line of Georgia avenue of said city, and the bridge to be constructed at right angles to said stream to a point on the north side thereof. Said bridge shall be constructed to provide for the passage of street cars, wagons, and vehicles, and the transit of animals and foot-passengers, and equal facilities for passage across said bridge shall be afforded to all wagons and vehicles and the cars of all street car companies.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which no higher charge shall be made for the transmission over the same of the mails, troops, and munitions of war of the United States than the rate per mile paid for the transportation over the highways leading to said bridge; and it shall enjoy the rights and privileges of other post-routes in the United States, and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 3. That if said bridge shall be made with unbroken and continuous spans, the two main spans thereof shall be over the main channels of the river, and not less than three hundred feet each in length in the clear, and the remaining spans shall not be less than two hundred feet each in length in the clear. The lowest part of the superstructure of the south span of said bridge shall not be less than one hundred feet and the remaining spans not less than ninety feet above low-water mark, as understood at the point of location, and the bridge shall be at right angles to and its piers parallel to the current of the river: *Provided*, That if any bridge built under this act shall be constructed as a pivot draw-bridge, its draw shall be over the main channel at an accessible and the best navigable point, and with spans giving a clear water-way, measured at the lowest stage of water known at the locality, of not less than one hundred and sixty feet in the clear on each side of the central or pivot pier of the draw; the main unbroken span of the bridge shall not be less than three hundred feet in the clear, and the remaining spans not less than two hundred feet each in the clear, and the lowest part of the superstructure of all the principal spans shall not be less than seventy-five feet above low-water mark, as understood at the point of location, and the piers of said bridge shall be parallel to, and the bridge itself at right angles to, the current of the river: *Provided*, That said draw shall be opened promptly upon reasonable signals for the passage of boats or vessels; and said corporation shall maintain at its own expense, from sunset to sunrise, such light or other signals as the Light-House Board shall prescribe.

SEC. 4. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War for his examination and approval a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river; the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plans of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War. Said company shall be allowed to charge reasonable tolls for transit over said bridge, but the Secretary of War shall have the right from time to time to revise, prescribe, and determine such rates or tolls.

SEC. 5. The right to alter, amend, or repeal this act, so as to prevent or remove all material and substantial obstructions to the navigation of said river by the construction of said bridge is hereby expressly reserved; and any alteration or change that may be required by the Secretary of War in the bridge constructed under this act, or the entire removal thereof, shall be made by the corporation or party owning or controlling the same at its own expense. If any litigation shall be necessary for the purpose of enforcing the requirements of the War Department as to altering said bridge or removing the whole structure, the same shall be had in the circuit court of the United States within whose jurisdiction the bridge or any part thereof is located. If the construction of said bridge shall not be commenced within two and completed within four years after the passage of this act, all privileges conferred hereby, and this act, shall become null and void.

Approved, April 20, 1888.

AN ACT to authorize the construction of a bridge across the Mississippi River at Memphis, Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of Americ in Congress assembled, That the Kansas City and Memphis Railway and Bridge Company, a corporation created and organized under and by virtue of the laws of the State of Arkansas, its successors and assigns, be, and the same are hereby, authorized and empowered to erect, construct, and maintain a bridge over the Mississippi River, from or near the town of Hopefield, in the State of Arkansas, to or near the taxing district of Shelby County, commonly known as the city of Memphis, in the State of Tennessee. Said bridge shall be constructed to provide for the passage of railway trains, and wagons and vehicles of all kinds, for the transit of animals, and, at the option of the corporation by which it may be built, for foot-passengers, fo such reasonable rates of toll as may be approved from time to time by the Secretary of War.

SEC. 2. That any bridge built under this act and subject to its limitations shall b a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mail the troops, and munitions of war of the United States than the rate per mile paid fo the transportation over the railroad or public highways leading to the said bridge and it shall enjoy the rights and privileges of other post-roads in the United State

SEC. 3. That the said bridge shall be made with unbroken and continuous spa Before approving the plans for said bridge, the Secretary of War shall order thre engineer officers from the Engineer Bureau to be detailed to the duty of examinin by actual inspection, the locality where said bridge is to be built, and to report wh shall be the length of the main channel-span and of the other spans: *Provided*, Th the main channel-span shall in no event be less than seven hundred feet in length, o the other spans less than six hundred feet each in length; and if the report of sa officers shall be approved by the Secretary of War, the spans of said bridge shall b of the length so required. The lowest part of the superstructure of said bridge sha be at least seventy-five feet above extreme high-water mark, as understood at th point of location, and the bridge shall be at right angles to, and its piers paralle with, the current of the river. No bridge shall be erected or maintained under th authority of this act which shall at any time substantially or materially obstruct th free navigation of said river; and if any bridge erected under such authority shal in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectuall obviate such obstruction; and all such alterations shall be made and all such o structions be removed at the expense of the owner or owners of said bridge; and i case of any litigation arising from any obstruction or alleged obstruction to the fre navigation of said river caused or alleged to be caused by said bridge, the case ma be brought in the circuit court of the United States within whose jurisdiction an portion of said obstruction or bridge may be located: *Provided further*, That nothin in this act shall be so construed as to repeal or modify any of the provisions of la now existing in reference to the protection of the navigation of rivers, or to exem this bridge from the operation of the same.

SEC. 4. That all railroad companies desiring the use of said bridge shall have an be entitled to equal rights and privileges relative to the passage of railway trains o cars over the same, and over the approaches thereto, upon payment of a reasonab compensation for such use; and in case the owner or owners of said bridge and th several railroad companies, or any one of them, desiring such use shall fail to agre upon the sum or sums to be paid, and upon rules and conditions to which each sha conform in using said bridge, all matters at issue between them shall be decided b the Secretary of War, upon reasonable notice to the parties in interest and upon co sideration of such allegations and proofs as may be submitted to him. But the la foregoing provision shall not be held to exclude the ordinary jurisdiction of the cour of the United States in such cases.

SEC. 5. That any bridge authorized to be constructed under this act shall be bu and located under and subject to such regulations for the security of navigation o said river as the Secretary of War shall prescribe; and to secure that object, the sa companies or corporations shall submit to the Secretary of War, for his examinati and approval, a design and drawings of the bridge and a map of the location, givin for the space of two miles above and two miles below the proposed location, the t pography of the banks of the river, the shore-lines at extreme high and low water, the direction and strength of the currents at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War, the bridge shall not be built or commenced; and should any change be made in the plans of said bridge during the progress of construction, such change shall be subject to approval of the Secretary of War, and shall not be made or commenced until the same is so approved.

SEC. 6. That it shall be the duty of the Secretary of War, on satisfactory proof that a necessity exists therefor, to require the company or persons owning said bridge to cause such aids to the passage of said bridge to be constructed, placed, and maintained at their own cost and expense, in the form of booms, dikes, piers, or other suitable and proper structures for the guiding of rafts, steam-boats, and other water-craft safely through the passage-way, as shall be specified in his order in that behalf; and on failure of the company or persons aforesaid to make and establish and maintain such additional structures within a reasonable time, the said Secretary may cause the said bridge to be removed at the expense of the owners thereof or may proceed to cause the same to be built or made at the expense of the owners of said bridge and in that case shall refer the matter without delay to the Attorney-General of the United States, whose duty it shall be to institute, in the name of the United States, proceedings in any circuit court of the United States within whose jurisdiction such bridge or any part thereof is located, for the recovery of the amount so expended by the Government and all costs of such proceedings; and all moneys accruing from such proceedings shall be covered into the Treasury of the United States.

SEC. 7. That if the construction of the bridge hereby authorized shall not be commenced within one year from the time this act takes effect, and be completed within four years after the same date, then this act shall be void, and all rights hereby conferred shall cease and determine.

SEC. 8. That an act entitled "An act to authorize the construction of a bridge across the Mississippi River at Memphis, Tennessee," approved February twenty-sixth, eighteen hundred and eighty-five, be, and the same is hereby, repealed.

SEC. 9. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal, at the expense of the owners, whenever the Secretary of War shall decide that the public interests require it, is also expressly reserved.

Approved, April 24, 1888.

AN ACT to facilitate the prosecution of works projected for the improvement of rivers and harbors.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War may cause proceedings to be instituted, in the name of the United States, in any court having jurisdiction of such proceedings, for the acquirement by condemnation of any land, right of way, or material needed to enable him to maintain, operate or prosecute works for the improvement of rivers and harbors for which provision has been made by law; such proceedings to be prosecuted in accordance with the laws relating to suits for the condemnation of property of the States wherein the proceedings may be instituted: *Provided, however,* That when the owner of such land, right of way, or material shall fix a price for the same, which in the opinion of the Secretary of War, shall be reasonable, he may purchase the same at such price without further delay: *And provided further,* That the Secretary of War is hereby authorized to accept donations of lands or materials required for the maintenance or prosecution of such works.

Approved, April 24, 1888.

AN ACT authorizing the Kansas City, Texarkana and Gulf Railway Company to bridge the Red and Little Rivers, in the State of Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Kansas City, Texarkana and Gulf Railway Company, its successors or assigns, be, and is hereby, authorized to construct and maintain a railway bridge, and approaches thereto, over and across Red River, in the State of Arkansas, at or near the point where the eastern boundary line of the State of Texas intersects the said river and the State line of the State of Arkansas; and also a railway bridge, and approaches thereto, over and across Little River, in the said State of Arkansas, at such point as may be selected by said railway company for crossing said river with its railroad line. Said bridges shall be constructed to provide for the passage of railway trains, and, at the option of said company, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War. That if the said bridges, or either of them, over the said rivers shall be made with unbroken and continuous spans, there shall be at least one span of a height of not less than eighty feet above low water or fifty feet above highest water, as understood at the point of location, measured to the lowest part of the superstructure of said bridge; and said span shall have a clear opening of at least two hundred feet between the piers, measured at right angles to the current, and shall be over the main channel of the river, and the bridge or bridges shall be at right angles to, and the piers parallel with, the current of the river. And if the bridges, or either of them, over the said rivers, shall be constructed as draw or pivot bridges, the draw or pivot pier shall be over the main channel of the river at an accessible navigable point, and the openings on each side of the pivot-pier shall not be less than one hundred and thirty feet in the clear, unless otherwise expressly directed by the Secretary of War, and if so directed shall be according to such direction, and, as nearly as practicable, the said openings shall be accessible at all stages of water, and the spans shall be not less than ten feet above extreme high water, as understood at the point of location, to the lowest part of the superstructure of the bridge, and the piers and draw rests shall be parallel with, and the bridge or bridges at right angles to, the current of the river or rivers; and no riprap or other outside protection for imperfect foundations shall be permitted to approach nearer than four feet to the surface of the water at its extreme low stage, or otherwise to encroach upon the channel-ways provided for in this act; and all and each of said draws shall be opened promptly upon reasonable signal for the passing of boats; and said company shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridges as the Light-House Board may prescribe.

SEC. 2. That any bridge built under this act, and subject to its limitations, shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States.

SEC. 3. That no bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said rivers; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge or bridges to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge. And in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the district court of the United States for the State of Arkansas in whose jurisdiction any portion of said obstruction or bridge may be located: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers or to exempt said bridges from the operation of the same.

SEC. 4. That all railway companies desiring the use of said bridges, or either of them, shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use.

SEC. 5. That the bridges authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said rivers as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of said bridges, and each of them, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge or bridges are approved by the Secretary of War the bridge or bridges shall not be built: and should any change be made in the plan of said bridges, or either of them, during the progress of construction, such change shall be subject to approval of the Secretary of War; and the said structures shall be changed at the cost and expense of the owners thereof, from time to time, as the Secretary of War may direct, so as to preserve the free and convenient navigation of said rivers; and the authority to erect and continue any and all of said bridges shall be subject to revocation by the Secretary of War whenever the public good, in his judgment, so requires.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge or bridges herein authorized be not commenced within one year and completed within three years from the approval of this act.

Approved, May 1, 1888.

AN ACT to authorize the city of Chicago to erect a crib in Lake Michigan for water-works purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby given to the city of Chicago, county of Cook, State of Illinois, to extend a tunnel, or inlet pipes, into Lake Michigan, so far as may be deemed necessary, to insure a supply of pure water and to erect a pier or piers and crib in the navigable waters of said lake, for the making, preserving and working of said aqueducts or pipes or tunnel, the plan and location thereof to be subject to the approval of the Secretary of War: *Provided,* That said city shall furnish and maintain at its own expense, such beacon-lights or other signals on such piers or crib, as the Light-House Board shall prescribe.

Approved, May 9, 1888.

AN ACT to amend an act to authorize the construction of a bridge across the Eastern Branch of the Potomac River at the foot of Pennsylvania avenue east.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he is hereby, authorized in his discretion to make such alterations in the plan of the bridge across the Eastern Branch of the Potomac River at the foot of Pennsylvania avenue east as will best accommodate the traffic over and under said bridge, and for said purpose the sum of sixty thousand dollars, or so much thereof as may be necessary, to be immediately available, be, and the same is hereby, appropriated, out of any money in the Treasury not otherwise appropriated: *Provided,* That the Baltimore and Potomac Railroad Company pay their fair and just proportion of the cost of said alteration at the west end of said bridge, to be determined by the Secretary of War: *Provided further,* That one half of the sum hereby appropriated shall be paid out of the revenues of the District of Columbia.

Approved, May 14, 1888.

AN ACT to authorize the Batesville and Brinkley Railroad to build a bridge across the Black River in Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Batesville and Brinkley Railroad Company, a corporation created and existing under the laws of Arkansas, be, and is hereby, authorized to erect and maintain a bridge across the Black River, in township twelve north, range three west, or at such point near said township as shall be selected by said railroad company for crossing said river with their railroad line, the said bridge to have a draw-span, so as not to interfere with the navigation of said river: *Provided,* That any bridge, constructed under this act and according to its limitations, shall be a lawful structure, and shall be known and recognized as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and munitions of war of the United States, or for through passengers or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads leading to the said bridge, and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 2. That the plan and location of said bridge, with a detailed map of the river at the proposed site of the bridge and near thereto, exhibiting the depths and currents, shall be submitted to the Secretary of War for his approval, and until he approves the plans and location of said bridge it shall not be built; but upon the approval of said plan by the Secretary of War the said company or corporation may proceed to the erection of said bridge in conformity with said approved plan, and should any change be made in the plan of said bridge during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War. And there shall be displayed on said bridge from sunset to sunrise such lights or other signals as may be prescribed by the Light-House Board.

SEC. 3. That Congress reserves the right to alter, amend, or repeal this act at any time; and that if at any time navigation of said river shall in any manner be obstructed or impaired by the said bridge, the Secretary of War shall have authority, and it shall be his duty, to require the said railroad company to alter and change the said bridge, at its own expense, in such manner as may be proper to secure free and complete navigation without impediment; and if upon reasonable notice to said railroad company to make such changes or improvements the said company fails to do so, the Secretary of War shall have authority to make the same at the expense of said company, and all the rights conferred by this act shall be forfeited; and Congress shall have power to do any and all things necessary to secure the free navigation of the said river.

SEC. 4. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year, and completed within three years from the date thereof.

Approved, May 14, 1888.

AN ACT to authorize the construction of the Ohio Connecting Railway Company Bridge.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Ohio Connecting Railway Company be, and the same is hereby, authorized to construct, maintain, and operate a bridge over the Ohio River from the south shore to the north shore thereof, at a point about one-half mile south of the mouth of Cork's Run in Allegheny County, Pennsylvania. Said bridge is hereby declared to be a lawful structure, and the same may be used for railroad and highway purposes. Said bridge to be constructed as follows: The main-channel span of said bridge shall be a continuous through span of five hundred and seven feet clear of masonry. The back-channel span shall be one through span of four hundred feet clear of masonry; said space in each case to be measured on the low-water line. The remaining spans of said bridge shall be deck-spans. Said main-channel span and said back-channel shall be at a height of not less than eighty feet above low-water mark at Market street in Pittsburgh and not less than eighty-two and one-half feet above local low-water mark at the bridge site, measured to the bottom chord of the bridge.

SEC. 2. The location of the piers of said bridge with reference to the current of the river shall be according to such plans and specifications as may be approved by the War Department: *Provided*, That no advertisement as required by the general law be again made, unless thought advisable and necessary by the Secretary of War, advertisement having already been made.

SEC. 3. That equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use, and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid and upon rules and upon conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties.

SEC. 5. That said bridge shall be constructed to provide for the passage of railway trains and, at the option of the corporation by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved, from time to time, by the Secretary of War.

SEC. 6. That the said bridge shall be built under the provisions of the act of seventeenth December, eighteen hundred and seventy-two, and authorizing the construction of bridges across the Ohio River and the amendatory act of fourteenth February, eighteen hundred and seventy-three, except in so far as the provisions of said acts may be modified or changed by the provisions of this act: *Provided*, That if the construction of said bridge shall not be commenced within one year, and completed within four years after the passage of this act, all privileges conferred hereby, and this act, shall become null and void.

SEC. 7. That Congress shall have power at any time to alter, amend or repeal this act.

Approved, May 14, 1888.

AN ACT to authorize the Tennessee Midland Railway Company to construct a bridge across the Tennessee River at any point on the line between the counties of Decatur and Perry, in the State of Tennessee, it may deem acceptable.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Tennessee Midland Railway Company, a corporation reated and organized under the laws of the State of Tennessee, be, and is hereby, authorized to construct and maintain, for the purpose of running railway trains, a bridge and approaches thereto, over the Tennessee River, at any point on the line between the counties of Decatur and Perry, in the State of Tennessee, which said company may deem most acceptable.

Sec. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which no higher charge shall be made for the transmissions over the same of the mails, troops, and the munitions of war of the United States passing over said bridge than the rate per mile paid for the transportation over the railroad leading to said bridge; and it hall enjoy the rights and privileges of other post roads in the United States. And equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

Sec. 3. That the bridge built under this act shall be constructed as a pivot drawbridge, with a draw over the main channel of the river at an accessible and the best navigable point and with spans of not less than one hundred and sixty feet in length n the clear on each side of the central or pivot pier of the draw, and said span shall be not less than ten feet above extreme high-water mark, measuring to the lowest part of the superstructure of the bridge, and the piers of said bridge shall be parallel to and the bridge itself at right angles to the current of the river at the average stage of water where said bridge may be erected: *Provided, also*, That in said bridge there hall be one span of not less than three hundred feet in length in the clear.

Sec. 4. That said draw shall be opened promptly by said company upon reasonable ignal for the passage of boats or vessels; and said corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals as the Light-House Board shall prescribe, and no bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of the river, and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge. And in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case shall be brought in the district court of the United States of the State of Tennessee in whose jurisdiction any portion of said obstruction or bridge may be located.

Sec. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War may prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

Sec. 6. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

Sec. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved without any liability of the United States on account of the alteration, amendment, or repeal of this act.

Sec. 8. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date of approval of this act.

Approved, May 14, 1888.

AN ACT to authorize the building of a railroad bridge at Little Rock, Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Little Rock Bridge and Terminal

Railroad Company, a corporation organized under the laws of the State of Arkansas, to construct and maintain a bridge, and approaches thereto, over the Arkansas River, at a point on said river at or near the city of Little Rock, in the State of Arkansas, and to lay on and over said bridge a railroad track or tracks for the more perfect connection of any railroad or railroads that are or shall hereafter be constructed to the said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided; said bridge shall be constructed to provide for the passage of railway trains, and at the option of the builders and owners thereof, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals of all kinds, and for foot-passengers for such reasonable rates of toll as may be approved, from time to time, by the Secretary of War as to railway trains: and as to wagons, vehicles, animals, and foot-passengers, such rates as may be provided by the laws of Arkansas.

SEC. 2. That any bridge built under this act is subject to its limitations, shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, troops, and the munitions of war, or other property of the United States, than the rate per mile paid for the transportation of the same over the railroads or public highways leading to the said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States. Equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 3. That the said bridge shall be constructed with a draw or pivot span which shall be over the main channel of the river at an accessible navigable point, and the openings on each side of the pivot pier shall not be less than one hundred and sixty feet in the clear, and, as nearly as practicable, both of said openings shall be accessible at all stages of water; that the spans be not less than ten feet above extreme high-water mark, as understood at the point of location, to the lowest point of the superstructure of said bridge; that the piers and draw rests of said bridge shall be built parallel with the current at that stage of the river which is most important for navigation, and the bridge of itself at right angles thereto; and that no riprap or other outside protection for imperfect foundations be permitted to approach nearer than four feet to the surface of the water at its extreme low stage, or otherwise to encroach upon the channel-ways provided for in this act: *Provided*, That said draw shall be opened by the company or persons owning said bridge upon reasonable signal for the passage of boats; and there shall be maintained, at the expense of the owners thereof, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 4. That all railroad companies desiring the use of said bridge shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains over the same, and over the approaches to the same, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and condition which each shall perform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to the regulations for the security of said river, as the Secretary of War shall prescribe; and to secure that object the owner or owners thereof shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-line at high or low water, the direction and strength of the current at all stages, and the soundings, actually showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for the full and satisfactory understanding of the subject, and until such plan and location of the bridge are approved by the Secretary of War, the bridge shall not be commenced or built, and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal at the expense of the owners thereof, whenever the Congress shall decide that the public interest requires it, is also expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, May 14, 1888.

AN ACT relating to the anchorage of vessels in the port of New York.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of the Treasury is authorized, empowered, and directed to define and establish an anchorage ground for vessels in the bay and harbor of New York, and in the Hudson and East Rivers, to adopt suitable rules and regulations in relation thereto, and to take all necessary measures for the proper enforcement of such rules and regulations.

SEC. 2. That in the event of the violation of any such rules or regulations by the owner, master, or person in charge of any vessel, such owner, master, or person in charge of such vessel shall be liable to a penalty of one hundred dollars, and the said vessel may be holden for the payment of such penalty, and may be seized and proceeded against summarily by libel for the recovery of the same in any United States district court for the district in which such vessel may be, and in the name of the officer designated by the Secretary of the Treasury.

SEC. 3. That this act shall take effect immediately.

Approved, May 16, 1888.

AN ACT granting to the city of Grand Forks, Dakota, the right to build two free bridges across Red River.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the city of Grand Forks, a municipal corporation organized under the laws of the Territory of Dakota, be, and the same is hereby, authorized by its proper officers to construct and maintain either one or two bridges and approaches thereto over the Red River of the North, at the most accessible points within said city across said river to the most convenient point or points in the State of Minnesota. Said bridge or bridges shall be constructed to provide for the free passage of wagons and vehicles of all kinds, for the transit of animals, for foot-passengers, and for such street railways as may be authorized by the city of Grand Forks to be constructed over the same.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized as a post-route, and shall enjoy the rights and privileges of other post-roads in the United States: *Provided*, That the United States may construct a postal telegraph over said bridge or bridges without charge therefor.

SEC. 3. That any bridge built under this act shall be constructed as a pivot draw-bridge, with a draw over the main channel at an accessible and the best navigable point, and with draw-spans giving a clear water way, measured at the lowest stage of water known at the locality, of not less than eighty feet in the clear on each side of the central or pivot pier; and the clear width, as herein provided for, shall not be reduced by deposits of riprap or by other material about the piers and abutments; and the spans shall not be of less elevation than three feet above extreme high-water mark, as known at the point of location, measured to the lowest part of the superstructure of said bridge; and provision shall be made in the location and construction of the abutments and approaches to allow the free passage of flood-water; and the piers of said bridge shall be parallel to, and the bridge itself at right angles to the direction of the current of said stream: *Provided, also*, That the said draw, or draws, shall be opened promptly by said corporation, upon reasonable signal, for the passage of boats, and said city shall maintain, at its own expense, such lights or other signals thereon as the Light-House Board may prescribe, and said city shall provide at its own expense such sheer-booms, guide-piers, or other device as may be at any time deemed necessary by the Secretary of War to facilitate the safe passage of boats or other water-craft through the spans of said bridge. No bridge shall be erected or maintained under authority of this act which shall at any time substantially or materially obstruct the free navigation of said river; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct said navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction, at the expense of said city of Grand Forks, and in case of any litigation arising from any obstruction, or alleged obstruction, to the free navigation of said river, caused, or alleged to be caused, by said bridges, or either, the case may be brought in the circuit court of the United States of the district in which said obstruction or bridges are located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt any bridge or bridges constructed by virtue hereof from the operations of the same.

SEC. 4. That any bridge or bridges authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said corporation shall submit to the Secretary of War, for his examination and approval, designs and drawings of the proposed bridges and a map of the location, giving, for the space of one mile above and one mile below the proposed locations, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plans and locations, or either of them, are approved by the Secretary of War there shall not be any bridge built at said point; and should any change be made in the plan of said bridge or bridges, during the progress of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 5. That the said city of Grand Forks, in the Territory of Dakota, is hereby authorized and empowered to issue in due form its municipal bonds to an amount not exceeding fifty thousand dollars, payable in twenty years, with interest at seven per centum annually, at said city's depository in Grand Forks, Dakota, for the purpose of defraying the necessary expenses, in whole or in part, for the erection of said bridge or bridges, and all acts or parts of acts of Congress or of the legislative assembly of said Territory of Dakota heretofore passed in conflict with this section be, and the same are hereby, repealed.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in such structure or structures, or the entire removal thereof, at the expense of the owners, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridges herein authorized be not commenced within one year, and completed within three years, from the date thereof.

Approved, May 21, 1888.

AN ACT to provide for the survey of certain historic grounds, locations, and military works.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and is hereby, authorized and directed to cause to be made, by an officer of the Engineer Corps, in co-operation with the Maumee Valley Monumental Association, an examination and inspection of each of the following-named historic grounds, locations, and military works, to wit:

The burial-place on Put-in-Bay Island of the sailors of the Navy in the war of eighteen hundred and twelve.

Fort Industry, at the mouth of Swan Creek, on the Maumee River.

Fort Miami, on the north and west side of the Maumee River, seven miles above Fort Industry.

Fort Meigs, and the burial grounds of the soldiers of the war of eighteen hundred and twelve, near the same, on the south and east bank of the Maumee River, ten miles above the mouth of Swan Creek.

A suitable portion of the battle-field of Fallen Timber, on the north and west bank of the Maumee River, four miles above Fort Meigs, where Anthony Wayne defeated the allied Indian nations under Turkey Foot, August twentieth, seventeen hundred and ninety-four.

Fort Defiance, at the confluence of the Auglaize and Maumee Rivers, erected by General Wayne in August, seventeen hundred and ninety-four.

Fort Wayne, at Fort Wayne, Indiana, at the confluence of the Saint Joe and Saint Mary's rivers, which was erected by General Wayne in October, seventeen hundred and ninety-four.

And he shall cause to be made a survey and full report to Congress of the location, situation, and condition of the same, and the amount of grounds necessary for the proper protection and improvement of the aforesaid works, forts, battle-fields, and burial-places in and near the same, as well as the probable cost thereof; and the said report shall be accompanied with the necessary maps and drawings.

SEC. 2. That the sum of one hundred and fifty dollars is appropriated, out of any money in the Treasury not otherwise appropriated, for the expense of the examination and inspection provided for in this act.

Approved, May 24, 1888.

AN ACT authorizing the construction of bridges across the Cape Fear River, Black River, and the Northeast River, in the State of North Carolina.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the Cape Fear and Yadkin Valley Railway Company, a corporation duly organized and existing under the laws of the State of North Carolina, its successors and assigns, to construct and maintain bridges, and approaches thereto, over the Cape Fear River at or near the town of Fayetteville, in the State of North Carolina, over the Black River, in the countyof Bladen, and over the Northeast River, in the county of New Hanover, in said State, at such point or points as said railway company may desire or find most practicable in the final location of its road to the city of Wilmington.

SEC. 2. That said bridges shall be so constructed either by draw, span, or otherwise, that a free and unobstructed passage may be secured to all vessels, boats, or other water-craft navigating said rivers.

SEC. 3. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, and shall enjoy all the rights and privilegesof other post-roads of the United States. And equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 4. That if either ofsaid bridges authorized to be constructed by this act shall be constructed as a draw-bridge, the draw shall be opened promptly by said corporation upon reasonable signal for the passage of boats, and said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge or bridges as the Light-House Board shall prescribe. No bridge shall be erected or maintained under the authority of this act, which shall at any time substantially or materially obstruct the free navigation of said river or rivers; and if any bridge or bridges erected under such authority, shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction, and all such obstructions shall be removed and alterations made at the expense of the owner or owners of said bridge: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt any bridge erected under this act from the operations of the same.

SEC. 5. That all railroad companies desiring the use of the bridge constructed under this act shall have, and be entitled to, equal rights and privileges, relative to the passage of railway trains, cars, and locomotives over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of the said bridge and the several railroad companies, or any of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all such matters of difference between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 6. That any bridge erected or authorized to be constructed under this act shall be built and located under, and subject to, such regulations for the security of navigation of said rivers as the Secretary of War shall prescribe, and to secure that object, said company or corporation shall submit to the Secretary of War a design and drawing of said bridge or bridges, for his examination and approval, and a map of its location, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and in all things shall be subject to such rules and regulations as may be prescribed by the Secretary of War, and until such plan and location of said bridge or bridges are approved, they shall not be built.

SEC. 7. That the right to alter, amend, or repeal this act is expressly reserved.

SEC. 8. That this act shall take effect and be in force from and after its passage.

SEC. 9. That this act shall be null and void if actual construction of the bridges herein authorized be not commenced within one year and completed within three years from the approval of this act.

Approved, June 6, 1888.

AN ACT to authorize the construction of bridges across the Kentucky River, and its tributaries, by the Louisville, Cincinnati and Virginia Railway Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Louisville, Cincinnati and Virginia Railway Company, a corporation organized under act of the general assembly of the Commonwealth of Kentucky, be, and it is hereby, authorized to construct and maintain a bridge, and approaches thereto, over the Kentucky River, in the State of Kentucky; and also a bridge or bridges over the tributaries or forks of said river, at such point or points as said company may deem suitable for the passage of its said road over said river, or its tributaries or forks. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the company by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals and for foot-passengers; and all tolls charged for the passage of vehicles, animals, and foot-passengers over said bridge shall be subject to modification and approval of the Secretary of War.

SEC. 2. That any bridge built under this act, and subject to its limitations, shall be a lawful structure, and shall be recognized and known as a post-route, and it shall enjoy the rights and privileges of other post-roads in the United States.

SEC. 3. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge, and a map of the location thereof: and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction such change shall be subject to the approval of the Secretary of War. All changes required by the Secretary of War in the structure of said bridge, or its entire removal after the same is constructed, shall be at the expense of the company owning or controlling said bridge; and in event of any litigation in reference to said bridge, or any part thereof, the same shall be had in the circuit court of the United States within whose jurisdiction said bridge or any part thereof may be located.

SEC. 4. That all railroad companies desiring the use of said bridge or bridges shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of reasonable compensation therefor; and in case the owner or owners of said bridge or bridges and the railroad company or companies desiring to use same shall fail to agree upon the terms with reference to the use of same, all matters of issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That this act shall be null and void if actual construction of the bridge or bridges herein authorized be not commenced within two years and completed within five years from the date thereof.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, June 6, 1888.

AN ACT to authorize the removal of an obstruction to the navigation of Broad Creek, in the State of Delaware.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the bridge over Broad Creek, a navigable stream upon which improvements have been made by appropriations authorized by Congress, erected and maintained by the Delaware Railroad Company and its lessee, near the town of Laurel, in the State of Delaware, is hereby declared to be an obstruction to the navigation of said Broad Creek and detrimental to the commerce thereof.

SEC. 2. That the Secretary of War is hereby directed to serve upon the said Delaware Railroad Company and its lessee in the manner prescribed by the laws of the State of Delaware for the service of papers upon corporations, a notice in writing, requiring said company or its lessee, within three months of the time of such notice, to remove said obstruction by placing in said bridge and maintaining therein a draw of sufficient width and dimensions to admit the free and easy passage of all steamboats and other vessels navigating said stream and in case of refusal or neglect of said railroad company or its lessee to place in said bridge a suitable draw as required by the aforesaid notice, the Secretary of War is hereby authorized and directed to cause a draw to be placed therein, and the cost and expense of such draw shall be a legal charge against the said railroad company and its lessee.

SEC. 3. That such sum of money as may be necessary to execute the provisions of this act by the Secretary of War is hereby appropriated, out of any money in the Treasury of the United States not otherwise appropriated, to be paid out on the requisition of the Secretary of War.

Approved, June 8, 1888.

AN ACT to extend the time for the completion of a bridge across Staten Island Sound.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the further time of one year from and after the sixteenth day of June, eighteen hundred and eighty-eight, be, and the same is hereby allowed to the Staten Island Rapid Transit Railroad Company and the Baltimore and New York Railroad Company, or either of them, to build the bridge across the Staten Island Sound or Arthur Kill, from New Jersey to Richmond County, New York, pursuant to the provisions of the act entitled "An act to authorize the construction of a bridge across the Staten Island Sound," known as Arthur Kill, and to establish the same as a post-road, passed the sixteenth day of June, eighteen hundred and eighty-six. But this act shall have no other effect whatever than to operate as if the time herein mentioned had been embraced in the said act.

Approved, June 9, 1888.

AN ACT to authorize the construction of a bridge across the Tennessee River at or near Chattanooga, Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Chattanooga Western Railway, a corporation created and organized under the laws of the State of Tennessee, be, and is hereby, authorized to construct and maintain a bridge, and approaches thereto, over the Tennessee River, at or near the city of Chattanooga, Tennessee, in the county of Hamilton. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the corporation by which it is built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot passengers, for reasonable rates or tolls, to be fixed by said company, and approved by the Secretary of War.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, and shall enjoy the rights and privileges of other post-roads in the United States. That no higher charge shall be made for the transmission over the same of the mail, troops, and munitions of war of the United States, or for through railway passengers or freight passing over said bridge, than the rate per mile for their transmission over the railroad leading to said bridge, and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge for postal-telegraph purposes; that the said bridge shall be constructed either by draw, span, or otherwise, so that a free and unobstructed passage-way may be secured to all water-craft navigating said river at the point aforesaid: *Provided*, That if said bridge authorized to be constructed under this act shall be constructed as a draw-bridge, the draw shall be opened promptly upon reasonable signals for the passage of boats or vessels; and said corporation shall maintain at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 3. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any one of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters to issue between them shall be decided by the Secretary of War upon the hearing of the allegations and proofs of the parties.

SEC. 4. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile below and one mile above the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, so as to prevent or remove all substantial obstruction to the navigation of said river such change shall be subject to the approval of the Secretary of War; and if any litigation shall be had in regard to said bridge, the same shall be in the circuit court of the United States in whose territorial jurisdiction said bridge, or any part thereof, is located.

SEC. 5. That the right to alter, amend, or repeal this act, is hereby expressly reserved; and any alterations or changes that may be required by Congress in the bridge constructed under this act, or its entire removal, shall be made by the corporation owning or controlling the same, at its own expense. Furthermore, if the construction of said bridge shall not be commenced within two and completed within four years after the passage of this act, all privileges conferred hereby, and this act shall become null and void.

Approved, June 9, 1888.

AN ACT authorizing the construction of a bridge over the Tennessee River at or near Guntersville, Alabama, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Tennessee and Coosa Railroad Company of Alabama, a corporation duly and legally incorporated under the laws of the State of Alabama, its successors or assigns, to construct and maintain a bridge over the Tennessee River at or near Guntersville, Alabama. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the persons by whom it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over said bridge, than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States. And equal privileges in the use of said bridge shall be granted to all companies upon such terms as may be agreed upon by the parties, and if they can not agree then as the same shall be determined by the Secretary of War; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 3. That the said bridge shall be constructed as a draw-bridge; the draw or pivot-pier shall be at such point in the channel of the river as the Secretary of War may direct, and the opening or passage-way of said draw-pier shall be so protected and arranged that water-craft can be worked through it at any and all times; and the draw-span shall not be of less width, nor shall the lowest part of the same be of less elevation above high water, than are the widest and highest of those authorized by Congress for any bridge over the Tennessee River, and the piers of said bridge shall be parallel with and the bridge itself at right angles to the current of the river: *Provided,* That in said bridge there shall be one span of not less than three hundred feet in the clear: *Provided, also,* That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said river; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge: and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river caused or alleged to be caused by said bridge, the cause may be brought in the circuit court of the United States of the State of Alabama in whose territorial jurisdiction any portion of said obstruction or bridge may be located: *Provided, further,* That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the operation of the same.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built. And if any change is required by the Secretary of War in the plan of said bridge, whilst the same is in process of construction, or after its completion, or if the entire removal of said bridge is required by him any time, the cost of such change or removal shall be paid by the company owning or controlling said bridge.

SEC. 6. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, June 9, 1888.

AN ACT to authorize the Fort Smith and Choctaw Bridge Company to construct a bridge across the Poteau River in the Choctaw Nation, near Fort Smith, Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Fort Smith and Choctaw Bridge Company, a corporation duly created and organized under the laws of the State of Arkansas, their successors or assigns, to build, construct, and maintain a bridge and approaches thereto for the passage of wagons, cars, and vehicles of all kinds for the transit of animals and for foot-passengers across the Poteau River in the Choctaw Nation at or near Fort Smith, upon the land owned and claimed by Mrs. M. A. Bower, a member of the Choctaw tribe of Indians.

SEC. 2. That if said bridge shall be made with unbroken and continuous span, the spans shall not be less than seventy feet in the clear, and the main span shall be over the main channel of the river. The lowest part of the superstructure of said bridge shall be at least thirty feet above extreme high water, as understood at the point of location: *Provided,* That if the same shall be constructed as a draw-bridge, the draw or pivot shall be over the main channel of the river at an accessible navigable point, and give a clear opening of seventy feet in width, and the spans shall not be less than ten feet above extreme high-water mark, as understood at the point of location, to the lowest part of the superstructure of said bridge: *Provided also,* That said draw shall be opened promptly upon reasonable signal for the passing of boats.

SEC. 3. That said corporation is authorized to take and use for all purposes of a highway or approaches to said bridge, and for no other purpose, a right of way not exceeding fifty feet in width on each side of said Poteau River, over the lands claimed by individuals under the laws and usages of said tribe of Choctaw Indians, and may contract for and obtain the same from such Indian or Indians by purchase: *Provided,* That no part of the lands herein authorized to be taken be leased or sold by the company, and they shall not be used except in such manner and for such purposes only as shall be necessary for the construction and convenient operation of said highway; and when any portion thereof shall cease to be so used, such portion shall revert to the individual Indian or Indians from which the same shall have been taken.

SEC. 4. That before said highway shall be constructed through any lands held by individual occupants according to the laws, customs, and usages of the Choctaw Nation, full compensation shall be made to such occupants for all property to be taken or damage done by reason of the construction of such highway In case of failure to make amicable settlements with any occupant, such compensation shall be determined by the appraisement of three disinterested referees, to be appointed, one, who shall act as chairman, by the President, one by the chief of the nation to which said occupant belongs, and one by the said bridge company; who, before entering upon the duties of their appraisements, shall take and subscribe before a district judge, clerk of a district court, or United States commissioner, an oath that they will faithfully and impartially discharge the duties of their appraisement, which oath, duly certified, shall be returned with their award to and filed with the Secretary of the Interior within sixty days from the completion thereof, and a majority of said referees shall be competent to act in case of the absence of a member after due notice. And upon the failure of either party to make such appointment within thirty days after the appointment made by the President, the vacancy shall be filled by the district judge of the United States court held at Fort Smith, Arkansas, upon the application of the other party. The chairman of said board shall appoint the time and place of all hearings within the nation to which such occupant belongs. Each of said referees shall receive for his services the sum of four dollars per day for each day they are engaged in the trial of any cause submitted to them under this act, with mileage at five cents per mile. Witnesses shall receive the usual fees allowed by the court of said nation. Costs, including compensation of said referees, shall be made a part of the award, and be paid by such bridge company. In case the referees do not agree, then any two of them are authorized to make the award. Either party being dissatisfied with the finding of the referees shall have the right, within ninety days after the making of the award and notice of the same, to appeal by original petition to the district court held at Fort Smith, Arkansas, which court shall have jurisdiction to hear and determine the subject-matter of the petition, according to the laws of the State of Arkansas, for determining the damage when property is taken for railroad purposes. If, upon the hearing of said appeal, the judgment of the court shall be for a larger sum than the award of the referees, the costs of said appeal shall be adjudged against the bridge company. If the judgment of the court shall be for the same or a less sum than the award made by the referees, then the costs shall be adjudged against the party claiming damages. When proceedings have been commenced in court, the bridge company shall pay double the amount of the award into court to abide the judgment thereof and then have the right to enter upon the property sought to be condemned and proceed with the construction of said bridge.

SEC. 5. That the bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe.

SEC. 6. That the said bridge company may charge such reasonable rate of tolls for the transit or passage over the same of wagons and vehicles of every description for animals and foot-passengers as are provided by existing laws of the Choctaw Nation.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 8. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, June 18. 1888

AN ACT granting to the York Harbor and Beach Railroad Company a right of way.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the right of way, four rods in width, across the military reservation at Fort McClary, in the town of Kittery, in the State of Maine, be, and the same hereby is, granted to the York Harbor and Beach Railroad Company, a corporation created by the laws of the said State of Maine, and said company is authorized to construct, maintain, and operate its railroad on said right of way, according to the location thereof, as recorded in the office of the commissioners of the county of York, in the State of Maine, and described in the temporary revocable license issued by the War Department to said company on the tenth day of June, in the year eighteen hundred and eighty-seven: *Provided,* That the Government may at any time terminate the aforesaid right of way whenever it may be deemed necessary for military purposes or the sale of the property.

Approved, June 18, 1888.

AN ACT to authorize the county of Laurens, in the State of Georgia, to construct a bridge across the Oconee River, at or near Dublin, in said county and State.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the county of Laurens, in the State of Georgia, be authorized and permitted to build a wagon and foot bridge across the Oconee River, at such point as it may select, at or near Dublin, in the said county and said State.

SEC. 2. That such bridge shall be made as the Secretary of War may prescribe: *Provided,* That said bridge may be used for the passage of wagons or vehicles of all kinds, for the transit of animals and for foot-passengers, for such reasonable toll as may be provided from time to time by the authorities of said county, or the same shall, at the option of said county, be a free bridge.

SEC. 3. That the bridge authorized to be constructed under this act shall be a lawful structure, and shall be recognized and known as a post-route, and it shall enjoy the rights and privileges of other post-roads in the United States, and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way for a postal telegraph across said bridge. Said bridge shall be built and located under and subject to such regulations for the security of navigation of navigable rivers as the Secretary of War shall prescribe; and o secure that object the said county of Laurens shall submit to the Secretary of War, or his examination and approval, a design and drawing of such bridge, and a map of he location, giving, for the space of one mile above and one mile below the proposed ocation, the topography of the banks of the river, and the shore-line at high and ow water, channel of the stream, and shall furnish such other information as may be equired for a full and satisfactory understanding of the subject; and until the said lans and location of the bridge are approved by the Secretary of War the bridge hall not be built; and should any change be made in the plan of such bridge during he progress of construction thereof, such change shall be subject to the approval of he Secretary of War.

Sec. 4. That if the construction of the bridge hereby authorized shall not be commenced within two years from the time this act takes effect, and be completed within our years after its commencement, then this act shall be void.

Sec. 5. That the right to alter, amend, or repeal this act is hereby expressly reerved, and the right to require any changes in said structure, or its entire removal at the expense of the owners, whenever Congress shall decide that the public interest equires it, is also expressly reserved.

Approved, June 18, 1888.

AN ACT to authorize the construction of a bridge across the Mississippi River at Hickman, Kentucky.

Be it enacted by the Senate and House of Representatives of the United States of America n Congress assembled, That the Paducah and Hickman Railroad and Bridge Company, a corporation created and organized under and by virtue of the laws of the State of Kentucky, its successors and assigns, be, and the same are hereby, authorized and empowered to erect, construct, and maintain a bridge over the Mississippi River from a point at or near the city of Hickman, in the State of Kentucky, to a point opposite thereto in the State of Missouri. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the corporation by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

Sec. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

Sec. 3. That the said bridge shall be made with unbroken and continuous spans. Before approving the plans for said bridge, the Secretary of War shall order three engineer officers from the Engineer Bureau to be detailed to the duty of examining, by actual inspection, the locality where said bridge is to be built, and to report what shall be the length of the main channel span and of the other spans: *Provided*, That the main channel span shall in no event be less than seven hundred feet in length, or the other spans less than six hundred and fifty feet each in length; and if the report of said officers shall be approved by the Secretary of War, the spans of said bridge shall be of the length so required. The lowest part of the superstructure of said bridge shall be at least eighty-five feet above extreme high-water mark, as understood at the point of location, and the bridge shall be at right angles to and its piers parallel with the current of the river. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said river; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made, and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction to the free navigation of said river caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States within whose jurisdiction any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the same.

Sec. 4. That all railroad companies desiring the use of said bridge shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains or cars over the same upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe, and to secure that object the said companies or corporations shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and maps of the location, giving, for the space of two miles above and two miles below the proposed location, the topography of the banks of the river, the shore-lines at extreme high and low water, the direction and strength of the currents at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plans of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal at the expense of the owners, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

SEC. 7. That it shall be the duty of the Secretary of War, on satisfactory proof that a necessity exists therefor, to require the company or persons owning said bridge to cause such aids to the passage to be constructed, placed, and maintained, at their own cost and expense, in the form of booms, dikes, piers, or other suitable and proper structures for the guiding of rafts, steam-boats, and other water-craft safely through the passage-way, as shall be specified in his order in that behalf; and on failure of the company or persons aforesaid to make and establish such additional structures within a reasonable time, the said Secretary shall proceed to cause the same to be built or made at the expense of the United States, and shall refer the matter without delay to the Attorney-General of the United States, whose duty it shall be to institute, in the name of the United States, proceedings in any circuit court of the United States within whose jurisdiction such bridge, or any part thereof, is located for the recovery of the amount so expended by the Government and all costs of such proceedings; and all moneys accruing from such proceedings shall be covered into the Treasury of the United States.

SEC. 8. That if the construction of the bridge hereby authorized shall not be commenced within one year from the time this act takes effect, and be completed within three years after its commencement, then this act shall be void, and all rights hereby conferred shall cease and determine.

Approved, June 19, 1888.

AN ACT to authorize the construction of a bridge over the Missouri River at or near the city of Omaha, Nebraska.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Nebraska Central Railway Company, a corporation existing under the laws of the State of Nebraska, be, and is hereby, authorized to construct, operate, and maintain a bridge over the Missouri River at or near the city of Omaha, in said State of Nebraska; said bridge when built shall not be located less than one-third of one mile from any other bridge across said river, then built or in process of construction. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the persons by whom it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War; and in case of any litigation concerning any alleged obstruction to the free navigation of said river on account of said bridge, the cause may be tried before the circuit court of the United States in whose jurisdiction any portion of said obstruction or bridge is located.

SEC. 2. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same for the mails, the troops, and the munitions of war of the United States than the rate per mile paid for their transportation over railroads or public highways leading to said bridge; and the United States and all companies and individuals shall have the right of way for telegraph, postal telegraph, and telephone purposes across said bridge.

SEC. 3. That if said bridge shall be made with unbroken and continuous spans it shall not be of less elevation in any case than fifty feet above high-water mark, as understood at the point of location, to the lowest member or the bridge superstructure, nor shall the spans of said bridge over the main channel of said river be less than three hundred and fifty feet in length, and the piers of said bridge shall be parallel with the current of said river, and the bridge itself at right angles thereto: *Provided*, That if said bridge be constructed as a draw-bridge, it shall be constructed as a pivot draw-bridge, with a draw over the main channel of the river at an accessible and the best navigable point, and with spans of not less than two hundred feet in length in the clear on each side of the central or pivot pier of the draw; and said spans shall not be less than ten feet above low-water mark, measuring to the lowest member of the bridge superstructure. *And provided also*, That said draw shall be opened promptly upon reasonable signal, except when trains are passing over the said bridge, for the passage of the boats whose construction shall not be such as to admit of their passage under the draw of said bridge when closed; but in no case shall unnecessary delay occur in opening the said draw after the passage of trains; and the said company or corporation shall maintain at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules or conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and if said bridge is not commenced within two years and completed within four years from the passage of this act, the rights and privileges hereby granted shall be null and void.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure or its entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interest requires it, is also expressly reserved.

SEC. 7. This act shall be null and void unless the construction of the bridge hereby authorized shall be commenced within two years and be completed within four years from the date of the approval of this act.

Approved, June 22, 1888.

AN ACT to authorize the construction of a bridge across the Tennessee River at or near Knoxville, Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Carolina, Knoxville and Western Railway Company, organized under the laws of the State of Tennessee, be, and is hereby, authorized to construct and maintain a bridge, and approaches thereto, over the Tennessee River, at or near the city of Knoxville, Tennessee, in the county of Knox. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the corporation by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot passengers, for reasonable rates or tolls, to be fixed by said company; and the Secretary of War shall have the right, from time to time, to revise, prescribe, and determine such rates or tolls.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, and it shall enjoy the rights and privileges of other post-roads in the United States. That the bridge authorized to be constructed under this act shall be a lawful structure and shall be recognized and known as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mail, troops, and munitions of war of the United States, or for through railway passengers or freight passing over said bridge, than the rate per mile for their transmission over the railroad leading to said bridge, and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes; that the said bridge shall be so constructed either by draw, span, or otherwise, that a free and unobstructed passage-way may be secured to all water-craft navigating said river at the point aforesaid: *Provided*, That if said bridge authorized to be constructed under this act shall be constructed as a draw-bridge, the draw shall be opened promptly upon the resonable signals for the passage of boats or vessels; and said corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 3. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any one of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon the hearing of the allegations and proofs of the parties.

SEC. 4. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile below and one mile above the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be submitted to and subject to the approval of the Secretary of War.

SEC. 5. That the right to alter, amend, or repeal this act, so as to prevent or remove all material and substantial obstruction to the navigation of said river by the construction of the said bridge, is hereby expressly reserved; and any alterations or changes that may be required by Secretary of War in the bridge constructed under this act, or its entire removal shall be made by the corporation owning or controlling the same, at its own expense; and if any litigation shall arise in regard to said bridge, the same may be had in the circuit court of the United States within whose territorial jurisdiction any part of said bridge is located. Furthermore, if the construction of said bridge shall not be commenced within two and completed within four years after the passage of this act, all privileges conferred hereby, and this act, shall become null and void.

Approved, June 25, 1888.

AN ACT to prevent obstructive and injurious deposits within the harbor and adjacent waters of New York City, by dumping or otherwise, and to punish and prevent such offenses.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the placing, discharging, or depositing, by any process or in any manner, of refuse, dirt, ashes, cinders, mud, sand, dredging, sludge, acid, or any other matter of any kind, other than that flowing from streets, sewers, and passing therefrom in a liquid state, in the tidal waters of the harbor of New York, or its adjacent or tributary waters, or in those of Long Island Sound, within the limits which shall be prescribed by the supervisor of the harbor, is hereby strictly forbidden, and every such act is made a misdemeanor, and ever person engaged in or who shall aid, abet, authorize, or instigate a violation of this section, shall, upon conviction, be punishable by a fine or imprisonment, or both, such fine to be not less than two hundred and fifty dollars nor more than two thousand five hundred dollars, and the imprisonment to be not less than thirty days nor more than one year, either or both united, as the judge before whom conviction is obtained shall decide, one half of said fine to be paid to the person or persons giving information which shall lead to conviction of this misdemeanor.

SEC. 2. That any and every master and engineer, or person or persons acting in such capacity, respectively, on board of any boat or vessel, who shall knowingly engage in towing any scow, boat, or vessel loaded with any such prohibited matter to any point or place of deposit, or discharge in the waters of the harbor of New York, or in its adjacent, or tributary waters, or in those of Long Island Sound, or to any point or place elsewhere than within the limits defined and permitted by the supervisor of the harbor hereinafter mentioned, shall be deemed guilty of a violation of this act, and shall, upon conviction, be punishable as hereinbefore provided for offenses in violation of section one of this act, and shall also have his license revoked or suspended for a term to be fixed by the judge before whom tried and convicted.

SEC. 3. That in all cases of receiving on board of any scows or boats such forbidden matter or substance as herein described, it shall be the duty of the owner or master, or person acting in such capacity, on board of such scows or boats, before proceeding to take or tow the same to the place of deposit, to apply for and obtain from the supervisor of the harbor appointed hereunder, a permit defining the precise limits within which the discharge of such scows or boats may be made; and any deviation from such dumping or discharging place specified in such permit shall be a misdemeanor within the meaning of this act; and the master and engineer, or person or persons acting in such capacity, on board of any tow-boat towing such scows or boats, shall be equally guilty of such offense with the master or person acting in the capacity of master of the scow, and be liable to equal punishment.

SEC. 4. That all mud, dirt, sand, dredgings, and material of every kind and description whatever taken, dredged, or excavated from any slip, basin, or shoal in the harbor of New York, or the waters adjacent or tributary thereto, and placed on any boat, scow, or vessel for the purpose of being taken or towed upon the waters of the harbor of New York to a place of deposit, shall be deposited and discharged at such place or within such limits as shall be defined and specified by the supervisor of the harbor, as in the third section of this act prescribed, and not otherwise. Every person, firm, or corporation being the owner of any slip, basin, or shoal, from which such mud, dirt, sand, dredgings, and material shall be taken, dredged, or excavated, and every person, firm, or corporation in any manner engaged in the work of dredging or excavating any such slip, basin, or shoal, or of removing such mud, dirt, sand, or dredgings therefrom, shall severally be responsible for the deposit and discharge of all such mud, dirt, sand, or dredgings at such place or within such limits so defined and prescribed by said supervisor of the harbor; and for every violation of the provisions of this section the person offending shall be guilty of an offense against this act, and shall be punished by a fine equal to the sum of five dollars for every cubic yard of mud, dirt, sand, dredgings, or material not deposited or discharged as required by this section. Any boat or vessel used or employed in violating any provision of this act, shall be liable to the pecuniary penalties imposed thereby, and may be proceeded against, summarily by way of libel in any district court of the United States, having jurisdiction thereof.

SEC. 5. That a line officer of the Navy shall be designated by the President of the United States as supervisor of the harbor, to act under the direction of the Secretary of War in enforcing the provisions of this act, and in detecting offenders against the same. This officer shall receive the sea-pay of his grade, and shall have personal charge and supervision under the Secretary of War, and shall direct the patrol boats and other means to detect and bring to punishment offenders against the provisions of this act.

SEC. 6. That the sum of thirty thousand dollars or so much thereof as may be necessary, is hereby appropriated to carry out the provisions of this act; and the Secretary of the Treasury is hereby authorized to pay that sum from moneys in the Treasury not otherwise appropriated.

Approved, June 29, 1888.

AN ACT to authorize the Paris, Choctaw and Little Rock Railway Company to construct a bridge across Red River at or near Hooks' Ferry, Red River County, Texas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Paris, Choctaw and Little Rock Railway Company, a corporation duly created and existing under the laws of the State of Texas, be, and is hereby, authorized to build a bridge across the Red River at or near Hooks' Ferry, Red River County, Texas, the said bridge to be so constructed as not to interfere with the navigation of said river: *Provided,* That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known and recognized as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for through passengers or freight passing over said bridge than the rate per mile paid for their transportation over the railroads leading to the said bridge; and the United States shall have the right of way for a postal telegraph across said bridge.

SEC. 2. That any bridge constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company shall submit to the Secretary of War, for his examination and approval, a design of the drawings of the bridge and piers, and a map of the location, giving, for the space of at least one mile above and one mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, and the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and if any change be made in the plan of construction of said bridge during the progress of the work thereon, or before the completion of said bridge, such change shall be subject to the approval of the Secretary of War; and the said structure shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through or under said structure; and the said structure shall be changed, at the cost and expense of the owners thereof, from time to time, as the Secretary of War may direct, so as to preserve the free and convenient navigation of said river; and the authority to erect and continue said bridge shall be subject to the revocation or modification by law whenever the public good shall, in the judgment of the Secretary of War, so require, without any expense or charge to the United States; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river caused or alleged to be caused by said bridge, suit may be brought in the circuit courts of the United States of Texas or Arkansas, in whose jurisdiction any portion of said bridge may be located.

SEC. 3. That Congress reserves the right to alter, amend, or repeal this act at any time; and that if at any time navigation of the said river shall in any manner be obstructed or impaired by the bridge authorized by this act to be constructed, the Secretary of War shall have authority, and it shall be his duty, to require the said railway company to alter and change the said bridge, at its own expense, in such manner as may be proper to secure free and complete navigation without impediment, and if, upon such reasonable notice to said railway company to make such change or improvements, the said company fails to do so, the Secretary of War shall have the authority to make the same, and all the rights conferred by this act shall be forfeited, and the Secretary of War shall have power to do any and all things necessary to secure the free navigation of the river.

SEC. 4. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, June 29, 1888.

AN ACT to authorize the construction of a bridge across Trail Creek, in the city of Michigan City, Indiana.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress be, and is hereby, granted to the city of Michigan City, a corporation duly organized under the laws of the State of Indiana, to construct, use, operate, and maintain a swing-bridge, with the necessary appurtenances, across Trail Creek, at the intersection of Franklin street in the city of Michigan City with said creek, for the passage of foot-passengers, animals, and vehicles of all kinds: *Provided*, That the plans and specifications, with the necessary drawings of said bridge shall be submitted to the Secretary of War for his approval; and until he approves the plan and location of said bridge it shall not be commenced; and should any change be made in the plan of said bridge during the progress of the work thereon such change shall likewise be subject to the approval of the Secretary of War; and said bridge shall be constructed in accordance with the plans and specifications as approved: *Provided also*, That no bridge shall be commenced under authority of this act until the Secretary of War shall have certified in writing that in his opinion the construction and maintenance of such bridge will not at any time substantially or materially obstruct the ordinary navigation of the said creek: *Provided also*, That if tolls shall be collected for passage or transportation across said bridge, the rates thereof shall be subject to the approval of the Secretary of War, who shall have power to fix said rates at reasonable amounts.

SEC. 2. That if the construction of the bridge hereby authorized shall not be commenced within one year from the time this act takes effect, and be completed within

ree years after its commencement, then this act shall be void, and all rights hereby
nferred shall cease and determine.

Sec. 3. That the right to alter, amend, or repeal this act so as to prevent or remove
ny material obstructions to the navigation of said creek, and so as to enforce any of
e conditions of this act, is hereby expressly reserved; and any change needful to
revent or remove any such material obstructions shall be made at the expense of
id city of Michigan City.

Approved, June 29, 1888.

N ACT authorizing the construction of a bridge across the Red River of the North by the Duluth, Rainy Lake River and Southwestern Railway Company.

Be it enacted by the Senate and House of Representatives of the United States of America
Congress assembled, That the assent of Congress is hereby given to the Duluth,
ainy Lake River and Southwestern Railroad Company, a corporation existing under
he laws of the State of Minnesota, and to its successors and assigns, to construct and
aintain a pivot draw-bridge, and approaches thereto, across the Red River of the
orth, between the State of Minnesota and the Territory of Dakota, at such point on
aid river, on the boundary-line between Marshal County or Kittson County, in the
tate of Minnesota, and the Territory of Dakota, as may accommodate the lines of
ailroad which said corporation may build to said point. Said bridge shall be con-
tructed to provide for the passage of railway trains, and, at the option of the said
orporation, may be used for the passage of wagons and vehicles of all kinds, for the
ransit of animals, and for foot-passengers, for reasonable tolls to be fixed by the Sec-
etary of War; and the Secretary of War shall have the right, from time to time to
evise such tolls.

Sec. 2. That the bridge authorized by this act shall be constructed as a pivot draw-bridge, with a draw over the main channel at an accessible and the best navigable point, and with spans giving a clear width of water-way measured at the lowest stage of water known at the locality, of not less than eighty feet in the clear on each side of the central or pivot pier of the draw, and the bottom chord of said bridge shall not be of less elevation than one foot above the plane of the highest known flood at the locality; and provision shall also be made in the location and construction of abutments and approaches to allow the free passage of flood water; and the piers of said bridge shall be parallel to and the bridge itself at right angles to the direction of the current of said river. And said corporation shall provide, at its own expense, such sheer-booms, guide-piers, and other devices as may be necessary to facilitate the safe passage of boats or other water-craft through the spans of said bridge: *Provided,* That the draw of said bridge shall be opened promptly upon reasonable signals for the passage of boats or vessels; and said corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light House Board shall prescribe. The said bridge shall be located and built under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company shall submit to the Secretary of War, for his examination and approval, a design and drawings of said bridge, and a map of the location, giving, for the space of one mile below and one mile above the proposed location the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed and channel of the stream, and shall furnish such other information as shall be required for a full and satisfactory understanding of the subject; and until the said location and plan of the bridge hereby authorized to be constructed are approved by the Secretary of War the said bridge shall not be built; and should any change be made in the plan of such bridge during the progress of construction thereof, such change shall be subject to the approval of the Secretary of War; and no such change shall be made until so approved.

Sec. 3. That all railroad companies desiring the use of the bridge constructed under this act shall have and be entitled to equal rights and privileges relative to the passage of railway trains, cars, and locomotives over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use, to be fixed by the Secretary of War, in case the owner or owners of the said bridge and the several railway companies, or any of them desiring such use, shall fail to agree upon the sum or sums to be paid; and the Secretary of War shall prescribe the rules and conditions to which each shall conform in using said bridge, and all matters of difference between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

Sec. 4. That the bridge authorized to be constructed under this act shall be a lawful structure, and shall be recognized and known as a post-route, and the same is hereby declared to be a post-route upon which also no higher charge shall be made for the transmission over the same of the mails, troops, and munitions of war of the United States, or for through railway passengers or freight passing over said bridge, than the rate per mile for the transmission over the railroads leading to said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 5. That the right to alter, amend, or repeal this act is hereby expressly reserved; and any alterations or changes that may be required by Congress in the bridge constructed under this act so as to prevent or remove all material and substantial obstruction to the navigation of said river by the construction of said bridge shall be made by the corporation owning or controlling the same, at its own expense.

SEC. 6. That in case of any litigation arising from any obstruction or alleged obstruction caused by this bridge to the free navigation of said river, the cause may be tried before the circuit court of the United States in whose territorial jurisdiction said bridge or any part thereof is located.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, June 29, 1888.

AN ACT authorizing the construction of a railroad bridge across the Red River of the North by the North Dakota and Pacific Railway Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the North Dakota and Pacific Railroad Company, a corporation existing under the laws of the State of Minnesota, and to its successors and assigns, to construct and maintain a bridge, and approaches thereto, across the Red River of the North, between the State of Minnesota and the Territory of Dakota, at such point on said river on the boundary-line between Norman or Polk County in the State of Minnesota, and Traill or Cass County in the Territory of Dakota, as may accommodate the lines of railroad which said corporation may build to said point. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the said corporation, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers for reasonable rates or tolls to be fixed by said company; and the Secretary of War shall have the right, from time to time, to revise, prescribe, and determine such rates or tolls.

SEC. 2. That any bridge built under this act shall be constructed as a pivot draw-bridge, with a draw over the main channel at an accessible and the best navigable point, and with spans giving a clear water-way, measured at the lowest stage of water known at the locality, of not less than eighty feet in the clear on each side of the central or pivot pier of the draw; and the bottom chord of the bridge shall not be of less elevation than one foot above the plane of the highest flood known at the locality, and provision shall also be made in the location and construction of abutments and approaches to allow the free passage of flood water; and the piers of said bridge shall be parallel to and the bridge itself at right angles to the current of said river: *Provided*, That said draw shall be opened promptly upon reasonable signal for the passage of boats and other water-craft, except when trains are passing over said draw; but in no case shall unnecessary delay occur in opening the said draw during or after the passage of trains; and said corporation shall maintain, at its own expense, from sunset to sunrise, such lights and other signals on said bridge as the Light-House Board shall prescribe; and said corporation shall provide, at its own expense, such sheer-booms, guide-piers, and other device as may be necessary to facilitate the safe passage of boats or other water-craft through the spans of said bridge. The said bridge shall be located and built under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company shall submit to the Secretary of War, for his examination and approval, a design and drawing of said bridge and a map of the location, giving for the space of one mile below and one mile above the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed and channel of the stream, and shall furnish such other information as shall be required for a full and satisfactory understanding of the subject; and until the said location and plan of the bridge hereby authorized to be constructed are approved by the Secretary of War, the said bridge shall not be built; and should any change be made in the plan of such bridge during the progress of construction thereof, such change shall be subject to the approval of the Secretary of War; and in case of any litigation arising from the obstruction or alleged obstruction caused by said bridge to the free navigation of said river, the cause may be tried before the circuit court of the United States in whose jurisdiction any portion of said bridge is located.

SEC. 3. That all railroad companies desiring the use of the bridge constructed under this act shall have, and be entitled to, equal rights and privileges, relative to the passage of railway trains, cars, and locomotives over the same and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of the said bridge and the several railroad companies, or any of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all such matters of difference between them shall be decided by the Secretary of War, upon a hearing of the allegations and proof of the parties.

SEC. 4. That the bridge authorized to be constructed under this act shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, troops, and the munitions of war of the United States, or for through railway passengers or freight passing over said bridge, than the rate per mile for their transmission over the railroads leading to said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 5. That the right to alter, amend, or repeal this act, so as to prevent or remove all material and substantial obstructions to the navigation of said river by the construction of the said bridge, is hereby expressly reserved; and any alterations or changes that may be required by the Secretary of War in the bridge constructed under this act, or its entire removal when completed shall be made by the corporation owning or controlling the same at its own expense; and if said bridge shall not be commenced in one year and be finished within three years from the passage of this act, the rights and privileges hereby granted shall be null and void.

Approved, June 29, 1888.

AN ACT to authorize the construction of a wagon and foot-passenger bridge across the Noxubee River, at or near Gainsville, in the State of Alabama.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the court of county commissioners of Sumter County, Alabama, be, and are hereby, authorized to construct and maintain, if, in the opinion of the Secretary of War, the same be a public necessity, a wagon and foot-passenger bridge across the Noxubee River, at a point at or near Gainsville, Alabama; that said bridge shall not interfere with the free navigation of said river beyond what is necessary in order to carry into effect the rights and privileges hereby granted; and in case of any litigation arising from any obstruction or alleged obstruction to the navigation of said river, the cause may be tried before the circuit court of the United States in and for any district in which any of said bridge obstruction may be. Said bridge shall be constructed to provide for the safe and convenient passage of wagons and vehicles of all kinds, animals, and foot-passengers. And if tolls shall be charged for the passage of wagons or other vehicles, or of animals and foot-passengers, the rates thereof may be fixed by the Secretary of War, on appeal to him for that purpose, and no higher charges shall be made than shall be established by him.

SEC. 2. That any bridge built under the provisions of this act may, at the option of Sumter County building the same, be built as a draw-bridge or with unbroken and continuous spans: *Provided*, That if the said bridge shall be made with unbroken and continuous spans it shall give clear head-room of not less, in any case, than forty-eight feet above extreme high-water mark as understood at the point of location, nor shall the spans of said bridge give a clear width of water-way of less than seventy-five feet, and the piers of said bridge shall be parallel with the current of said river, and the bridge itself at right angles thereto: *Provided also*, That if the said bridge be built as a draw-bridge, the draw shall be built over the main channel of the river at a convenient and the most accessible point, giving a clear width of water-way of not less than seventy-five feet, and that said draw shall be opened promptly upon reasonable signal for the passage of boats, and said county commissioners shall maintain, at their own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 3. That any bridge constructed under this act and according to its limitations shall be a lawful structure and shall be known as a postal-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the crossing of mails, troops, and munitions of war of the United States, and for freight passing over said bridge, than is charged for the same services from the public, and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way for postal telegraph purposes across said bridge.

SEC. 4. That the structure herein authorized shall be built and located under, and subject to, such regulations for the security of the navigation of said river as the Secretary of War shall prescribe, and to secure that object the said company or corporators shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and a map of the location, giving for space of one half mile above and below the proposed location the topography of the bank of the river, the current of the river at high and low water, the location of any other bridge or bridges, together with such other information as the Secretary of War may prescribe, and until the plan and location of the said bridge are approved by the Secretary of War the bridge shall not be built, and should any change be made in the plan of said bridge during the progress of construction, such changes shall be subject to the approval of the Secretary of War. And all expenses attending such changes shall be paid by the company constructing said bridge; or, if the Secretary of War shall require any change in said bridge or the entire removal of the same after its completion, the same shall be at the cost of the company, and if such changes or removal shall not be made when required, the Secretary of War may make such changes or removal, and cause proceedings to be instituted in the name of the United States in any circuit court of the United States in whose jurisdiction any part of said bridge is located to recover from the company or persons owning said bridge the amount which may be expended by the United States in such alterations or removal.

SEC. 5. That the right to alter, amend, or repeal this act is hereby expressly reserved.

SEC. 6. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, June 29, 1888.

AN ACT to authorize Dalles City to construct a bridge across the Columbia River, in the State of Oregon and Territory of Washington.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That Dalles City, in the county of Wasco and State of Oregon be authorized and permitted to build a wagon and foot bridge across the Columbia River at such point as it may select within a distance of five miles above said city. Such bridge may also, at the option of said city, be so constructed as to be available as a railroad bridge.

SEC. 2. That such bridge built under the provisions of this act may, at the option of said Dalles City, be built as a draw-bridge or with unbroken and continuous spans: *Provided*, That if such bridge shall be made with unbroken and continuous spans, the main span shall be of such width, and the lowest part of the superstructure shall be of such height above extreme high-water mark, as the Secretary of War may prescribe; and if such bridge built under this act shall be constructed as a draw-bridge, the same shall be constructed with an opening of such width, character, and construction as the Secretary of War shall prescribe: *Provided, also*, That said draws shall be opened promptly upon reasonable signal for the passage of boats, and in no case shall unnecessary delay occur: *Provided, also*, That said bridge, at the option of the said Dalles City, by which it may be built, may be used for the passage of wagons or vehicles of all kinds, for the transit of animals, and for foot passengers, for such reasonable rate of toll as may be provided from time to time by the common council of said city, and approved by the Secretary of War, or the same shall, at the option of said Dalles City, be a free bridge.

SEC. 3. That the bridge authorized to be constructed under this act shall be a lawful structure, and shall be recognized and known as a post-route, and it shall enjoy the rights and privileges of other post-roads in the United States; and the United States shall have the right of way for a postal telegraph across said bridge. Said bridge shall be built and located under and subject to such regulations for the security of navigation of navigable rivers as the Secretary of War shall prescribe; and to secure that object the said Dalles City shall submit to the Secretary of War, for his examination and approval, a design and drawing of such bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, and the shore-line at high and low water, channel of the stream, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plans and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of such bridge during the progress of construction thereof, such change shall be subject to the approval of the Secretary of War.

SEC. 4. That such alterations or changes as may be required by the Secretary of War or Congress in the bridge, constructed under the provisions of this act, shall be nade by the said Dalles City, at its own expense; and in the event of litigation growing out of the provisions of this act, the same shall be had in the circuit court of the United States within whose jurisdiction any part of said bridge may be located; and at any time after the completion of such bridge the said Dalles City may, at its opinion, surrender and transfer to the county of Wasco, in the State of Oregon, the said bridge, and the entire control and management thereof, in which event and in case of the acceptance thereof by said county of Wasco, they shall thenceforth be subject to all the obligations and conditions imposed on Dalles City by the provisions of this act. And it is hereby expressly provided that Congress reserves the right at any time to alter, amend, or repeal this act.

Approved, July 9, 1888.

AN ACT to authorize the construction of a bridge over the Cumberland River, between Burnside, Kentucky, and Carthage, in Tennessee, or the south fork of said river, between Burnside and Tateville, Kentucky.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Cincinnati and Birmingham Railroad Company, a corporation existing under the laws of the State of Tennessee, be, and is hereby, authorized to construct, operate, and maintain a bridge over the Cumberland River, between Burnside, Kentucky, and Carthage, Tennessee, or the south fork of said river, between Burnside and Tateville, in Kentucky. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the persons by whom it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War; and in case of any litigation concerning any alleged obstruction to the free navigation of said river on account of said bridge, the cause may be tried before the circuit court of the United States in whose jurisdiction any portion of said obstruction or bridge is located.

SEC. 2. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for their transportation over the railroads or public highways leading to said bridge; and the United States shall have the right of way for postal-telegraph and telephone purposes across said bridge.

SEC. 3. That said bridge shall be made under such specifications and plans as to the spans, draw-bridge, and so forth, as may be approved by the Secretary of War.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies or any of them desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and if said bridge is not commenced within two years and completed within four years from the passage of this act, the rights and privileges hereby granted shall be null and void.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure or its entire removal, at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interest requires it, is also expressly reserved.

Approved, July 9, 1888.

AN ACT authorizing the construction of railroad bridges across the Snake River and across the Clear Water River, by the Oregon Railway and Navigation Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the Oregon Railway and Navigation Company, a corporation incorporated and organized under the laws of the State of Oregon, and to its successors and assigns, to construct and maintain a bridge, and approaches thereto, across the Snake River, in the Territory of Washington, near Texas Ferry on said river; and also a bridge, and approaches thereto, across the Clear Water River, in the Territory of Idaho, between its mouth and the boundary-line of the Nez Percé Indian Reservation. Said bridges shall be so constructed as to provide for the passage of railway trains, and, at the option of the said corporations, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for reasonable rates of tolls to be fixed by said company.

SEC. 2. That any bridge built under this act shall be constructed as a pivot draw-bridge, with a draw over the main channel at an accessible and the best navigable point, and with spans giving a clear water-way, measured at the lowest stage of water known at the locality, of such width and height as the Secretary of War may, upon examination, prescribe; and the lowest part of the superstructure of the bridge shall be of such elevation above the plane of the highest flood known at the locality as the Secretary of War may deem advisable, and provision shall also be made in the location and construction of abutments and approaches to allow the free passage of flood water; and the piers of said bridges shall be parallel to and the bridges shall be at right angles to the current of the river: *Provided*, That the draw shall be opened promptly upon reasonable signal for the passage of boats and other water-craft, except when trains are passing over the draw; but in no case shall unnecessary delay occur in opening the draw during or after the passage of trains; and said corporation shall maintain, at its own expense, from sunset to sunrise, such lights and other signals on said bridges as the Light-House Board shall prescribe; and said corporation shall provide, at its own expense, such sheer-booms, guide-piers, and other devices as may be necessary to facilitate the safe passage of boats or other water-craft through the spans of said bridges. The said bridges shall be located and built under and subject to such regulations for the security of the navigation of said rivers as the Secretary of War shall prescribe; and to secure that object the said company shall submit to the Secretary of War, for his examination and approval, a design and drawings of each of said bridges and a map of the location, giving, for the space of one mile below and one mile above the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed and channel of the stream, and shall furnish such other information as shall be required for a full and satisfactory understanding of the subject; and until the said location and plans of the bridges hereby authorized to be constructed are approved by the Secretary of War, the said bridges shall not be built; and should any change be made in the plan of either of such bridges during the progress of construction thereof, such change shall be subject to the approval of the Secretary of War; and in case of any litigation arising from the obstruction or alleged obstruction caused by said bridges, or either of them, to the free navigation of said river, the cause may be tried before the circuit court of the United States in whose jurisdiction any portion of the bridge is located.

SEC. 3. That the bridges authorized to be constructed under this act shall be lawful structures, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, troops, and the munitions of war of the United States, or for through railway passengers or freight passing over said bridges, than the rate per mile for their transmission over the railroads leading to said bridges; and equal privileges in the use of said bridges shall be granted to all telegraph companies; and the United States shall have the right of way across said bridges and their approaches for postal-telegraph service.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That the right to alter, amend, or repeal this act, so as to prevent or remove all material and substantial obstructions to the navigation of said rivers by the construction of said bridges, is hereby expressly reserved; and any alterations or changes that may be required by Congress in the bridges constructed under this act shall be made by the corporation owning or controlling the same at its own expense; and if ither of said bridges shall not be commenced in one year and be finished within three ears from the passage of this act, the rights and privileges hereby granted as to such ridge shall be null and void.

Approved, July 9, 1888.

N ACT making appropriations for the legislative, executive, and judicial expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America *Congress assembled*, That the following sums be, and the same are hereby, approriated, out of any money in the Treasury not otherwise appropriated, in full comensation for the service of the fiscal year ending June thirtieth, eighteen hundred nd eighty-nine, for the objects hereinafter expressed, namely:

* * * * * * *

WAR DEPARTMENT.

* * * * * * *

IN THE OFFICE OF THE CHIEF OF ENGINEERS: One chief clerk, at two thousand ollars; four clerks of class four; two clerks of class three; three clerks of class wo; three clerks of class one; one clerk, at one thousand dollars; one assistant essenger; and two laborers; in all, twenty-three thousand two hundred and forty ollars.

And the services of skilled draughtsmen, civil engineers, and such other services s the Secretary of War may deem necessary may be employed in the office of the hief of Engineers to carry into effect the various appropriations for rivers and harors, fortifications and surveys for military defenses, to be paid for from such approriations: *Provided*, That the expenditures on this account for the fiscal year ending une thirtieth, eighteen hundred and eighty-nine, shall not exceed sixty thousand ollars; and that the Secretary of War shall each year, in the annual estimates, reort to Congress the number of persons so employed, and the amount paid to each.

* * * * * * *

PUBLIC BUILDINGS AND GROUNDS.

For clerk in the office of Public Buildings and Grounds, one thousand six hundred ollars; and for messenger in the same office, eight hundred and forty dollars.

For the public gardener, one thousand eight hundred dollars.

For overseers, draughtsman, foremen, mechanics, gardeners, and laborers employed n the public grounds, thirty thousand dollars.

For watchman in Franklin Square, six hundred and sixty dollars.

For watchman in Lafayette Square, six hundred and sixty dollars.

For two day-watchmen in Smithsonian Grounds, at six hundred and sixty dollars ach, one thousand three hundred and twenty dollars.

For two night-watchmen in Smithsonian Grounds, at seven hundred and twenty ollars each, one thousand four hundred and forty dollars.

For one watchman for Judiciary Square, and one for Lincoln Square and adjacent reservations, at six hundred and sixty dollars each; one thousand three hundred and wenty dollars.

For one watchman for Iowa Circle; one watchman for Thomas Circle and neighboring reservations; one for Rawlins Square and Washington Circle; one for Dupont ircle and neighboring reservations; one for McPherson and Farragut Squares; one for Stanton Square and neighboring reservations; two for Henry Square, Seaton Square, and reservations east to Botanic Garden; one for Mount Vernon Square and djacent reservations; one for greenhouse at the nursery; one for grounds south of Executive Mansion; eleven in all, at six hundred and sixty dollars each, seven thousand two hundred and sixty dollars.

For one night-watchman for Henry Square, Seaton Square, and reservations east to Botanic Garden, at seven hundred and twenty dollars.

For contingent and incidental expenses, five hundred dollars.

* * * * * * *

Approved, July 11, 1888.

AN ACT to authorize the Southwestern Arkansas and Indian Territory Railroad Company to build a bridge across the Ouachita River, in Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Southwestern Arkansas and Indian Territory Railroad Company, a corporation created and existing under the laws of Arkansas, be, and is hereby, authorized to erect and maintain a bridge across the Ouachita River, in township ten south, range seventeen west, or at such point near said township as has been selected by said railroad company for crossing said river with their railroad line, the said bridge to be of such height as not to interfere with the navigation of said river: *Provided*, That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known and recognized as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops and the munitions of war of the United States, or for through passengers or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads leading to the said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way for postal telegraph and telephone lines across said bridge.

SEC. 2. That the plan and location of said bridge, with a detailed map of the river at the proposed site of the bridge and near thereto, exhibiting the depths and currents, shall be submitted to the Secretary of War for his approval, and until he approve the plan and location of said bridge it shall not be built; but upon the approval of said plan by the Secretary of War the said company or corporation may proceed to the erection of said bridge in conformity with said approved plan, and should any change be made in the plan of said bridge during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War.

SEC. 3. That Congress reserves the right to alter, amend, or repeal this act at any time; and that if at any time navigation of the said river shall in the opinion of the Secretary of War be in any manner obstructed or impaired by the said bridge, the Secretary of War shall have authority, and it shall be his duty, to require the said railroad company to alter and change the said bridge, at its own expense, in such manner as may be proper to secure free and complete navigation without impediment; and if upon reasonable notice to said railroad company to make such changes or improvements the said company fails to do so, the Secretary of War shall have authority to make the same at the expense of said company, or to remove said bridge, and all the rights conferred by this act shall be forfeited; and Congress shall have power to do any and all things necessary to secure the free navigation of the said river.

SEC. 4. That the bridge hereby authorized to be constructed may be used by any other railroad company desiring to cross the Ouachita River at the point where said bridge is built. The amount of compensation to be paid the corporation controlling said bridge shall be fixed by the parties; and in the event of their being unable to agree on the amount, the Secretary of War shall establish such rate of compensation. The right of Congress to repeal, alter, or amend the provisions of this act is hereby expressly reserved.

SEC. 5. That unless the construction of this bridge be commenced within one and completed within three years after the passage of this act, all privileges conferred hereby shall become null and void.

Approved, July 16, 1888.

AN ACT to authorize the Columbia River Bridge Company to construct and maintain a bridge across the Columbia River between the State of Oregon and the Territory of Washington, and to establish it as a post-road.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Columbia River Bridge Company, a corporation created and existing under and by virtue of the laws of the State of Oregon, or its assigns, to erect, construct, and maintain a bridge over the Columbia River from La Camas in the Territory of Washington to a point on the westerly shore of the Sandy River in the State of Oregon. Said bridge shall be constructed to provide for the passage of the railway trains, and at the option of the corporation, or its assigns, by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, foot passengers, and of all kinds of commerce, travel, or communication.

SEC. 2. That any bridge built under the act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route upon which also no charges shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passengers or freight passing over said bridge than the rate per mile paid for the transportation over the railroad or public highways leading to said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States. And equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 3. That said bridge may be constructed as a draw-bridge, with an opening over the center of the channel of such width as the Secretary of War shall determine, and which shall be at least one hundred and twenty feet in the clear: *Provided, also,* That said draw shall be opened promptly upon reasonable signal for the passage of boats, vessels, or other water-craft, and in no case shall unnecessary delay occur; and said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe, and such sheer-booms or other structures as may be necessary to safely guide vessels, boats, rafts, or other water-craft safely through said draw openings as shall be designated and required by the Secretary of War.

SEC. 4. That said bridge shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe, and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge and a map of the location, giving for the space of one mile above and one mile below the proposed location the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the sounding, accurately showing the bed of the stream, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location are approved by the Secretary of War the bridge shall not be built, and should any changes be made in the plan of said bridge during the progress of construction, such change shall be submitted to the approval of the Secretary of War.

SEC. 5. That all railroad companies, desiring the use of said bridge, shall have and be entitled to equal rights and privileges relative to the passage of railway trains, engines, or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use, and in case the owner, or owners, of said bridge, and the several railroad companies, or any one of them, desiring such use, fail to agree upon the sum, or sums, to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties: *Provided,* That the provisions of section two, in regard to charges for passengers and freight across said bridge, shall not govern the Secretary of War in determining any question arising as to the sum, or sums, to be paid to the owners of said bridge by such railroad companies for the use of said bridge.

SEC. 6. That the right to alter, amend, or repeal this act, or to require any changes in such structure, or its entire removal at the expense of the owners thereof whenever the Secretary of War shall decide that the public interest requires it, and the right to prescribe such rules and regulations in regard to toll and otherwise, as may be deemed reasonable, are expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, July 16, 1888.

AN ACT authorizing the construction of a bridge across the Red River of the North.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the North Dakota and Pacific Railroad Company, a corporation existing under the laws of the State of Minnesota, and to its successors and assigns, to construct and maintain a bridge and approaches thereto, across the Red River of the North, between the State of Minnesota and the Territory of Dakota, at such point on said river on the boundary-line between Norman or Polk County, in the State of Minnesota, and Traill or Cass County, in the Territory of Dakota, as may accommodate the lines of railroad which said corporation may build to said point. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the said corporation, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for reasonable rates or tolls to be fixed by said company; and the Secretary of War shall have the right, from time to time, to revise, prescribe, and determine such rates or tolls.

SEC. 2. That any bridge built under this act shall be constructed as a pivot draw-bridge, with a draw over the main channel at an accessible and the best navigable point, and with spans giving a clear water-way, measured at the lowest stage of water known at the locality, of not less than eighty feet in the clear on each side of the central or pivot pier of the draw; and the bottom chord of the bridge shall not be of less elevation than one foot above the plane of the highest flood known at the locality, and provision shall also be made in the location and construction of abutments and approaches to allow the free passage of flood water: and the piers of said bridge

SEC. 9. That this act shall take effect and be in force from and after its passage.

SEC. 10. That this act shall be null and void if actual construction of the brid
authorized by this act be not commenced within one year and completed within t
years from the date of this act.

Approved, July 16, 1888.

AN ACT to authorize the construction of a bridge over the Tennessee River, between Bridgeport
Sheffield, Alabama.

Be it enacted by the Senate and House of Representatives of the United States of A
ica in Congress assembled, That the Cincinnati and Birmingham Railroad Company
corporation existing under the laws of the State of Tennessee, be, and is hereby, a
thorized to construct, operate, and maintain a bridge over the Tennessee River, b
tween Bridgeport and Sheffield, in the State of Alabama. Said bridge shall be c
structed to provide for the passage of railway trains, and at the option of the p
sons by whom it may be built, may be used for the passage of wagons and vehicles
all kinds, for the transit of animals, and for foot-passengers, for such reasonab
rates of toll as may be approved from time to time by the Secretary of War; and
case of any litigation concerning any alleged obstruction to the free navigation
said river on account of said bridge, the cause may be tried before the circuit co
of the United States in whose jurisdiction any portion of said obstruction or brid
is located.

SEC. 2. That any bridge constructed under this act and according to its limitatio
shall be a lawful structure, and shall be recognized and known as a post-route, up
which also no higher charge shall be made for the transmission over the same of t
mails, the troops, and the munitions of war of the United States than the rate p
mile paid for their transportation over the railroads or public highways leading
said bridge; and equal privileges in the use of said bridge shall be granted to a
telegraph companies; and the United States shall have the right of way for pos
telegraph and telephone purposes across said bridge.

SEC. 3. That said bridge shall be made under such specifications and plans as t
the spans, draw-bridge, and so forth, as may be approved by the Secretary of War.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and
entitled to equal rights and privileges relative to the passage of railroad trains ov
the same, and over the approaches thereto, upon the payment of a reasonable compe
sation for such use; and in case the owner or owners of said bridge and the several ra
road companies, or any of them desiring such use, shall fail to agree upon the sum
sums to be paid, and upon rules and conditions to which each shall conform in usi
said bridge, all matters at issue between them shall be decided by the Secretary
War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be bui
and located under and subject to such regulations for the security of navigation
said river as the Secretary of War shall prescribe; and to secure that object the sa
company or corporation shall submit to the Secretary of War, for his examination a
approval, a design and drawings of the bridge, and a map of the location, giving,
the space of one mile above and one mile below the proposed location, the topograp
of the banks of the river, the shore-lines at high and low water, the direction
strength of the currents at all stages, and the soundings, accurately showing the
of the stream, the location of any other bridge or bridges, and shall furnish
other information as may be required for a full and satisfactory understanding of
subject; and until the said plan and location of the bridge are approved by the
retary of War the bridge shall not be built; and should any change be made i
plan of said bridge during the progress of construction, such change shall be su
to the approval of the Secretary of War; and if said bridge is not comme
within two years and completed within three years from the passage of this act,
rights and privileges hereby granted shall be null and void.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressl
served, and the right to require any changes in said structure, or its entire rem
at the expense of the owners thereof, whenever the Secretary of War shall de
that the public interest requires it, is also expressly reserved.

Approved, July 16, 1888.

AN ACT to authorize the construction of a bridge over the Caney Fork River, between Rock
and Carthage, in Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of A
in Congress assembled, That the Cincinnati and Birmingham Railroad Compa
corporation existing under the laws of the State of Tennessee be, and is hereby,

orized to construct, operate, and maintain a bridge over the Caney Fork River, beween Rock Island and Carthage, in the State of Tennessee. Said bridge shall be onstructed to provide for the passage of railway trains and, at the option of the perons by whom it may be built, may be used for the passage of wagons and vehicles of ll kinds, for the transit of animals, and for foot-passengers, for such reasonable rates f toll as may be approved from time to time by the Secretary of War; and in case of ny litigation concerning any alleged obstruction to the free navigation of said river n account of said bridge, the cause may be tried before the circuit court of the United tates in whose jurisdiction any portion of said obstruction or bridge is located.

SEC. 2. That any bridge constructed under this act, and according to its limitations hall be a lawful structure, and shall be recognized and known as a post-route, upon hich also no higher charge shall be made for the transmission over the same of the ails, the troops, and the munitions of war of the United States than the rate per ile paid for their transportation over the railroads or public highways leading to id bridge; and equal privileges in the use of said bridge shall be granted to all elegraph companies; and the United States shall have the right of way for postal elegraph and telephone purposes across said bridge.

SEC. 3. That said bridge shall be made under such specifications and plans as to he spans, draw-bridge, and so forth as may be approved by the Secretary of War.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and e entitled to equal rights and privileges relative to the passage of railway trains ver the same, and over the approaches thereto, upon payment of a reasonable comensation for such use; and in case the owner or owners of said bridge and the sevral railroad companies, or any of them desiring such use, shall fail to agree upon the um or sums to be paid, and upon rules and conditions to which each shall conform in sing said bridge, all matters at issue between them shall be decided by the Secreary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built nd located under and subject to such regulations for the security of navigation of aid river as the Secretary of War shall prescribe; and to secure that object the said ompany or corporation shall submit to the Secretary of War, for his examination nd approval, a design and drawings of the bridge, and a map of the location, giving, for he space of one mile above and one mile below the proposed location, the topography f the banks of the river, the shore-lines at high and low water, the direction and trength of the currents at all stages, and the soundings, accurately showing the bed f the stream, the location of any other bridge or bridges, and shall furnish such ther information as may be required for a full and satisfactory understanding of the ubject; and until the said plan and location of the bridge are approved by the Secetary of War the bridge shall not be built; and should any change be made in the lan of said bridge during the progress of construction, such change shall be subject o the approval of the Secretary of War; and if said bridge is not commenced within wo years, and completed within four years from the passage of this act, the rights nd privileges hereby granted shall be null and void.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reerved, and the right to require any changes in said structure or its entire removal, t the expense of the owners thereof, whenever the Secretary of War shall decide hat the public interest requires it, is also expressly reserved.

Approved, July 16, 1888.

N ACT to authorize the construction of a railroad, wagon, and foot-passenger bridge across the Mississippi River at or near Clinton, Iowa.

Be it enacted by the Senate and House of Representatives of the United States of America n Congress assembled, That the Clinton and Illinois Bridge Company, a corporation rganized and existing under the laws of the State of Iowa, its successors and assigns, e, and they are hereby, authorized to construct and maintain, if in the opinion of he Secretary of War the same be a public necessity, a railroad, wagon, and foot-assenger bridge across the Mississippi River, at a place suitable to the interests of avigation, at a point at or near the city of Clinton, Iowa, and to lay on or over said ridge a track or tracks for the more perfect connection of any railroad or railroads hat are or shall be constructed to said river, on either or both sides thereof, at or pposite said point, under the limitations and conditions hereinafter provided; that aid bridge shall not interfere with the free navigation of said river, and in case of any itigation arising from any obstruction or alleged obstruction to the free navigation f said river, the cause may be tried before the circuit court of the United States in nd for any district in whose jurisdiction any portion of said bridge or obstruction ay be. Said bridge shall be constructed to provide for the passage of railroad trains, nd for the safe and convenient passage of wagons and vehicles of all kinds, animals, and foot-passengers, for such reasonable rates of toll as may be fixed from time to ti by the Secretary of War: *Provided*, That the proviso regarding wagons, animals, fo passengers, and so forth, shall not influence the location of said bridge in its relati to the interests of navigation.

SEC. 2. That any bridge built under the provisions of this act may, at the option the company building the same, be built as a pontoon draw-bridge or with unbrok and continuous spans: *Provided*, That if the said bridge shall be made with unbrok and continuous spans it shall have one or more channel-spans, each having not le than three hundred and fifty feet clear channel-way, and not less than fifty-five fe clear head-room above high-water mark, and the clear head-room under other th channel-spans may be less than fifty-five feet: *Provided*, That no part of the supe structure of such spans shall give a less head-room than ten feet above high-wat mark: *And provided further*, That the interests of navigation be not injured by su reduction in height, and the piers of said bridge shall be parallel with the curre and the bridge itself at right angles thereto: *And provided further*, That if any bri built under the provisions of this act shall be constructed as a draw-bridge, and sha have two or more draw-openings, each having not less than two hundred feet cle channel-way; and in addition to said draw-openings shall have one or more fixe channel-spans, each having not less than three hundred and fifty feet clear channe way; and every part of the superstructure shall have a clear head-room of not le than ten feet above high-water mark: *Provided*, That all spans of both high and lo bridges shall be so located as to afford the greatest possible accommodation to th river traffic, and a draw-opening of low bridges shall, if practicable, be located ne or near shore: *Provided, also*, That in case of a low bridge, if the physical characte istics of the locality so require and the interests of navigation be not injured thereb the lengths of fixed spans or the number of draw-openings may be reduced: *Provid* *also*, That for any two adjacent draw-openings of two hundred feet each, one draw-opening of three hundred feet may be substitutedif the interests of navigation be no injured thereby: *And provided, also*, That said draw shall be opened promptly upo reasonable signal for the passage of boats, except when trains are passing over th draw; but in no case shall unnecessary delay occur in opening the said draw durin or after the passage of trains: *And provided further*, That if any bridge built unde the provisions of this act shall be constructed as a pontoon bridge, it shall be bui subject to all the terms, requirements, and limitations contained in the act *entitl* "An act to legalize and establish a pontoon railway bridge across the Mississippi Rive at Prairie du Chien, and to authorize the construction of a similiar bridge at or nea Clinton, Iowa," approved June sixth, eighteen hundred and seventy-four: *And pr* *vided, also*, Such bridge may be provided with a pontoon draw giving not less tha four hundred feet clear channel-way for each navigable channel of the river, and such other openings for the passage of rafts and logs as, in the opinion of *the Secr* tary of War, may be necessary: *And provided further*, That the pile and ponto bridge shall be subject to all restrictions as regards plans, location, and accessori provided for in case of high and low bridges so far as they are applicable *to such kin* of bridge.

SEC. 3. That any bridge constructed under this act and according to its limitatio shall be a lawful structure, and shall be known as a post-route, and the same is hereb declared to be a post-route, upon which also no higher charge shall be made for transmission over the same of the mails, the troops, and the munitions of war of United States, and for passengers or freight passing over said bridge, than the per mile paid for their transportation over the railroads and public highways lead to said bridge; and equal privileges in the use of said bridge shall be granted to telegraph companies; and the United States shall have the right of way for pos telegraph purposes across said bridge.

SEC. 4. That all railway companies desiring to use said bridge shall have and entitled to equal rights and privileges in the passage of the same, and in the use the machinery and fixtures thereof, and of all the approaches thereto, under and such terms and conditions as shall be prescribed by the Secretary of War, upon h ing the allegations and proofs of the parties, in case they shall not agree.

SEC. 5. That the structure herein authorized shall be built and located under subject to such regulations for the security of the navigation of said river as Secretary of War shall prescribe; and to secure that object the said company or poration shall submit to the Secretary of War, for his examination and approva design and drawing of the bridge and a map of the location, giving, for the spa one mile above and one mile below the proposed location, the topography of the b of the river, the shore-line at high and low water, the direction and strength of the rent at all stages, and the soundings, accurately showing the bed of the stream, th cation of any bridge or bridges, and shall furnish such other information as sh required for a full and satisfactory understanding of the subject; and until the plan and location of the bridge are decided by the Secretary of War to be such as not materially affect the interests of navigation, the bridge shall not be comme or built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and the said bridge shall be constructed with such aids to the passage of said bridge, in the form of booms, dikes, piers, or other suitable and proper structures for confining the flow of water to a permanent and easily navigated channel, for a distance of not less than one mile above the bridge location, and for the guiding of rafts, steam-boats, and other water-craft safely through the draw and raft spans, as the Secretary of War shall prescribe and order to be constructed and maintained at the expense of the company owning said bridge; and the said structure shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through or under said structure; and for safety of vessels passing at night there shall be displayed on said bridge, from the hours of sunset to sunrise, such lights as may be prescribed by the Light-House Board; and the said structure shall be changed at the cost and expense of the owners thereof, from time to time, or entirely removed, as the Secretary of War may direct, so as to preserve the free and convenient navigation of said river; and the authority to erect and continue said bridge shall be subject to revocation and modification by law, when the public good, in the judgment of the Secretary of War, so requires, without any expense or charge to the United States.

SEC. 6. That if actual construction of the bridge herein authorized shall not be commenced within one year from the passage of this act, and be completed in three years from the same date, the rights and privileges hereby granted shall cease and be determined.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, July 16, 1888.

AN ACT to authorize the construction of a railroad, wagon, and foot-passenger bridge across the Mississippi River at or near Muscatine, Iowa.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Muscatine Bridge Company, its successors and assigns, be, and they are hereby, authorized to construct and maintain a railroad, wagon, and foot-passenger bridge across the Mississippi River at a place suitable to the interests of navigation, at a point at or near the city of Muscatine, Iowa, and to lay on or over said bridge a track or tracks for the more perfect connection of any railroad or railroads that are or shall be constructed to said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided; that said bridge shall not interfere with the free navigation of said river beyond what is necessary, and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, the cause may be tried before the circuit court of the United States in and for any district in whose jurisdiction any portion of said bridge or obstruction may be. Said bridge shall be constructed to provide for the passage of railroad trains, and for the safe and convenient passage of wagons and vehicles of all kinds, animals, and foot-passengers, for such reasonable rates of toll as may be fixed from time to time by the Secretary of War: *Provided,* That the proviso regarding wagons, animals, foot-passengers, and so forth, shall not affect the location of said bridge in its relation to the interests of navigation.

SEC. 2. That any bridge built under the provisions of this act may, at the option of the company building the same, be built as a draw-bridge or with unbroken and continuous spans: *Provided,* That if the said bridge shall be made with unbroken and continuous spans, it shall have one or more channel-spans, each having not less than three hundred and fifty feet clear channel-way, and not less than fifty-five feet clear head-room above high-water mark, and the clear head-room under other than channel-spans may be less than fifty-five feet: *Provided,* That no part of the superstructure of such spans shall give a less head-room than ten feet above high-water mark: *And provided further,* That the interests of navigation be not injured by such reduction in height: *And provided further,* That if any bridge built under the provisions of this act shall be constructed as a draw-bridge, the same shall be constructed as a pivot draw-bridge, which shall have two or more draw-openings, each having not less than two hundred feet clear channel-way, and in addition to said draw-openings, shall have one or more fixed channel-spans, each having not less than three hundred and fifty feet clear channel-way; and every part of the superstructure of said low bridge shall give a clear head-room of not less than ten feet above high-water mark: *Provided,* That all spans of both high and low bridges shall be so located as to afford the greatest possible accommodation to the river traffic, and a draw-opening of the low bridge shall, if practicable, be located next or near the shore :*Provided, also,* That in case of a low bridge, if the physical characteristics of the locality so require, and the interests of navigation be not injured thereby, the lengths of the fixed spans, or the number of draw-openings, may be reduced: *Provided, also,* That for any two adjacent draw-openings of two hundred feet one draw-opening of three hundred feet may be substituted, if the interests of navigation be not injured thereby; and the piers of said bridge shall be parallel with the current of the river where said bridge shall be erected, and the bridge itself at right angles thereto: *And provided, also,* That said draw shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over the draw; but in no case shall unnecessary delay occur in opening the said draw during or after the passage of trains.

SEC. 3. That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, and for passengers or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads and public highways leading to said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way for postal-telegraph purposes across said bridge.

SEC. 4. That all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passages of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties, in case they shall not agree.

SEC. 5. That the structure herein authorized shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-line at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any bridge or bridges, and shall furnish such other information as shall be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are decided by the Secretary of War to be such as will not materially affect the interests of navigation, the bridge shall not be commenced or built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and the said bridge shall be constructed with such aids to the passage of said bridge, in the form of booms, dikes, piers, or other suitable and proper structures for confining the flow of water to a permanent and easily navigated channel, for a distance of not less than one mile above the bridge location, and for the guiding of rafts, steam-boats, and other water-craft safely through the draw and raft spans, as the Secretary of War shall prescribe and order to be constructed and maintained at the expense of the company owning said bridge; and the said structure shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through or under said structure; and for the safety of vessels passing at night there shall be displayed on said bridge, from the hours of sunset to sunrise, such lights as may be prescribed by the Light-House Board; and the said structure shall be changed or removed at the cost and expense of the owners thereof from time to time, as the Secretary of War may direct, so as to preserve the free and convenient navigation of said river; and the authority to erect and continue said bridge shall be subject to revocation and modification when the public good, in the judgment of the Secretary of War, so requires, without any expense or charge to the United States.

SEC. 6. That if actual construction of the bridge herein authorized shall not be commenced within one year from the passage of this act, and be completed in three years from the same date, the rights and privileges hereby granted shall cease and be determined.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, July 16, 1888.

AN ACT authorizing the Little Rock and Alexandria Railway Company to maintain and construct a bridge across Bayou D'Arbonne, in Louisiana.

Be it enacted by the Senate and House of Representatives of the United States of Amer in Congress assembled, That the Little Rock and Alexandria Railway Company, Louisiana, and Arkansas, a corporation duly and legally organized and existing der and by virtue of the laws of the States of Louisiana and Arkansas, be, and is hereby authorized to construct and maintain a bridge, and approaches thereto, over Bayou D'Arbonne, in Union Parish, Louisiana, near the town of Farmerville, at the point where said company's line of railway as now projected crosses said bayou, or at such point as may be selected by said company. Said bridge shall be constructed to provide for the passage of railway trains, and at the option of said company by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

SEC. 2. That if said bridge over the said Bayou D'Arbonne shall be constructed with unbroken and continuous spans, there shall be at least one span of a height of not less than eighty feet above low water or fifty feet above highest water measured to the lowest part of the superstructure of said bridge, and said span shall have a clear opening of at least one hundred feet between the piers, measured at right angles to the current at every stage, and shall be over that portion of the bayou used by boats during the ordinary stages of water; and the bridge shall be at right angles to, and the piers parallel with, the current of the bayou. And if the said bridge over said Bayou D'Arbonne shall be constructed as a draw-bridge, the draw or pivot shall be over the main channel of the bayou at an accessible navigable point, and the opening on each side of the pivot-pier shall be not less than one hundred feet in the clear; and as nearly as practicable both of said openings shall be accessible at all stages of water, and the spans shall be not less than ten feet above extreme high water, as understood at the point of location, to the lowest part of the superstructure of the bridge, and the piers and draw-rests shall be parallel with, and the bridge itself at right angles to, the current of the bayou at that stage of the bayou which is most important for navigation; and no riprap or other outside protection for imperfect foundations shall be permitted to approach nearer than four feet to the surface of the water at its extreme low stage, or otherwise to encroach upon the channel-ways provided for in this act. Said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board may prescribe.

SEC. 3. That said bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 4. That if said bridge erected or maintained under the authority of this act shall at any time substantially or materially obstruct the free navigation of said bayou, or shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of such bridge to be made as will effectually obviate such obstruction; and such alteration shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States of the State of Louisiana in whose jurisdiction any portion of said obstruction or bridge may be located: *Provided*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt said bridge from the operation of the same.

SEC. 5. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use. And if the rate of compensation can not be agreed upon by the parties, the same shall be fixed by the Secretary of War.

SEC. 6. That the bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said bayou as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of said bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the bayou, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the

Secretary of War, the bridge shall not be commenced or built, and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War, and said structure shall be changed, at the cost and expense of the owners thereof, from time to time, as Congress may direct, so as to preserve the free and convenient navigation of said bayou; and the authority to erect and continue said bridge shall be subject to revocation by law whenever the public good shall, in the judgment of Congress, so require.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date of this act being approved.

SEC. 8. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, July 16, 1888.

AN ACT authorizing the construction of a bridge across the Missouri River at or near the city of Nebraska City, Nebraska, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the city of Nebraska City, Nebraska, a city and municipal corporation organized under the laws of the State of Nebraska, its successors or assigns, is hereby authorized to construct, maintain, and operate a bridge across the Missouri River at Nebraska City, in the county of Otoe and State of Nebraska, and at such a point as may be hereafter selected by said city, its successors or assigns, and at least one-third of a mile from any other bridge, as shall best promote the public convenience and welfare and the necessities of business and commerce, and also to construct and maintain the accessory works necessary to secure the best practicable channel-way for navigation and to confine the flow of the water to a permanent channel at such point, and also, if the said corporation, its successors or assigns, shall deem it for the best interests of the public so to do, to lay on and over said bridge a railway track for the more perfect connection of any railroads that are or shall be constructed to said river at or opposite to said point; and said corporation, its successors or assigns, shall construct and maintain ways for carriages, wagons, and for foot-passengers, and may charge and receive such reasonable toll therefor as may be approved from time to time by the Secretary of War: *Provided,* That said bridge and all the property belonging thereto or connected therewith may be constructed, maintained, and used as a combined railway and wagon bridge, for the safe and convenient passage of wagons, carriages, stock, steam, cable, and street cars, foot-passengers, and all road travel, or as a wagon bridge alone, for the safe and convenient passage of wagons, carriages, stock, and foot-passengers, as the said corporation, its successors or assigns, shall elect, as hereinbefore provided; but if the said corporation, its successors or assigns, shall elect to build a combined railroad and wagon bridge, then the track for wagons, carriages, stock and foot-passengers shall not be upon the same space as that used for railroad track and cars.

SEC. 2. That said bridge shall be constructed and built without material interference with the security convenience of navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure that object the said company or corporation, its successors or assigns, shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built: *Provided,* That said bridge shall be built as a high bridge with unbroken and continuous spans, having at least one channel-span of not *less* than four hundred feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than three hundred feet, and all spans shall have a clear head-room of not less than fifty feet above high-water mark, and the piers of said bridge shall be parallel with the current of said river and the bridge itself at right angles thereto, and no riprapping or other protection for imperfect foundations which will lessen the required water-way shall be permitted; and said company or corporation, its successors or assigns, shall maintain, at its own expense, from sunset until sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe: *And provided also,* That if said company or corporation, its *successors* or assigns, shall elect, as is hereinbefore provided, to erect a combined railroad and wagon bridge, then all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in *the* use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties in case they shall not agree.

SEC. 3. That the Secretary of War is hereby authorized and directed, upon receiving such plan and map and other information, and upon being satisfied that a bridge built on such plan and with such accessory work and at such locality, will conform to the prescribed conditions of this act, to notify the company, its successors or assigns, that he approves the same; and upon receiving such notification the said company, its successors or assigns, may proceed to an erection of said bridge, conforming strictly to the approved plan and location; and should any change be made in the plan of the bridge or said accessory works during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused, or alleged to be caused, by said bridge, the case may be brought in the circuit court of the United States for the State of Nebraska or the State of Iowa, in whose jurisdiction any portion of said obstruction or bridge may be located.

And the expense of altering said bridge or removing any obstructions to navigation in respect thereof shall be paid by the owners of or persons controlling said bridge.

SEC. 4. That the said bridge and accessory works, when built and constructed under this act and according to the terms and limitations thereof, shall be lawful structures; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes of the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes; and Congress reserves the right at any time to regulate by appropriate legislation the charges for freight and passengers over said bridge.

SEC. 5. That the United States shall have the right of way for such postal-telegraph lines across said bridge as the Government of the United States may construct and control.

SEC. 6. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within two years and completed within four years from the date thereof.

SEC. 7. That Congress shall have power at any time to alter, amend, or repeal this act.

SEC. 8. This act shall take effect and be in force from and after its passage.

Approved, July 16, 1888.

AN ACT to authorize the Birmingham, Selma and New Orleans Railroad Company to build a bridge across the Tombigbee River in Alabama.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Birmingham, Selma and New Orleans Railroad Company, a corporation created and existing under the laws of Alabama, be, and is hereby, authorized to erect and maintain a bridge across the Tombigbee River, at such point between Point Jackson and Demopolis as shall be selected by said railroad company for crossing said river with their railroad line, the said bridge to have a draw-span, so as not to interfere with the navigation of said river: *Provided*, That any bridge constructed under this act and according to its limitations shall be a lawful structure, and shall be known and recognized as a post-route, and the same is hereby declared to be a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and munitions of war of the United States, or for through passengers or freight passing over said bridge, than the rate per mile paid for their transportation over the railroads leading to the said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 2. That the plan and location of said bridge, with a detailed map of the river at the proposed site of the bridge and near thereto, exhibiting the depths and currents, shall be submitted to the Secretary of War for his approval, and until he approves the plans and location of said bridge it shall not be built; but upon the approval of said plan by the Secretary of War the said company or corporation may proceed to the erection of said bridge in comformity with said approved plan, and should any change be made in the plan of said bridge during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War. And th shall be displayed on said bridge from sunset to sunrise such lights or other sign as may be prescribed by the Light-House Board.

SEC. 3. That Congress reserves the right to alter, amend, or repeal this act at a time; and that if at any time navigation of said river shall in any manner be o structed or impaired by the said bridge, the Secretary of War shall have authori and it shall be his duty, to require the said railroad company to alter and change t said bridge, at its own expense, in such manner as may be proper to secure free a complete navigation without impediment; and if upon reasonable notice to said ra road company to make such changes or improvements the said company fails to do the Secretary of War shall have authority to make the same at the expense of s company, and all the rights conferred by this act shall be forfeited; and Congr shall have power to do any and all things necessary to secure the free navigation the said river.

SEC. 4. That all railroad companies desiring the use of said bridge shall have a be entitled to equal rights and privileges relative to the passage of railway trains cars over the same, and over the approaches thereto, upon payment of a reasonab compensation for such use; and in case the owner or owners of said bridge and t several railroad companies, or any of them, desiring such use, shall fail to agree up the sum or sums to be paid, and upon rules and conditions to which each shall co form in using said bridge, all matters at issue between them shall be decided by t Secretary of War upon a hearing of the allegations and proofs of the parties.

SEC. 5. That this act shall be null and void if actual construction of the bridg herein authorized be not commenced within two years and completed within fo years from the date thereof.

Approved, July 16, 1888.

AN ACT to authorize the construction of a bridge across the Missouri River and to establish it a post-road.

Be it enacted by the Senate and House of Representatives of the United States of Ameri in Congress assembled, That it shall be lawful for the Chicago, Oquaka and Kans City Short Line Railway Company, a corporation organized under the laws of t State of Illinois, or its successors or assigns, to construct a bridge across the Misso River at a point opposite or nearly opposite the town of Parkville, in the State Missouri; that said bridge may be constructed for railway and postal service, wi single or double tracks for railway traffic, and which shall be under the conditio and limitations hereinafter specified.

SEC. 2. That said bridge shall not interfere with the free navigation of said riv beyond what may be necessary to carry into effect the rights and privileges here granted; and in case of any litigation arising therefrom such litigation may be trie and determined by any circuit court of the United States whose jurisdiction embrac either terminus of said bridge.

SEC. 3. That the bridge hereby authorized to be constructed must be construct either as a draw-bridge or of unbroken spans. If constructed of unbroken spa then it shall not be less in elevation than fifty feet above extreme high water as u derstood and determined at the point of location, to the bottom chord of the bridg Nor shall the span of said bridge be less than three hundred and fifty feet in length and the piers thereof shall be parallel with the current of the river. The main sp shall be over the channel of the river and not less than two hundred and fifty feet i length. In case the said company shall elect to construct said bridge as a draw-bridge the same shall be constructed as a pivot draw-bridge, with a draw over the main cha nel with spans not less than two hundred feet in length in the clear on each side the pivot-piers, and the next adjoining spans to the draw shall not be less than o hundred feet, and the said span shall not be less than thirty feet above low-wat mark, and not less than ten feet above extreme high-water mark, measuring from th bottom chord of said bridge; and the piers of said bridge shall be parallel with th current of the river where said bridge may be erected. And it is further provid that said draw shall open promptly upon proper signal for the passage of boats.

SEC. 4. That any bridge constructed under this act shall be a lawful structure, an shall be known as a post-road, and the same is hereby declared to be a post-road, ove which no higher charge shall be made for the transmission of mails, troops, and mu nitions of war of the Government of the United States, or for passenger or freigh passing over the same, than the rate per mile charged for their transportation ove the railroad or public highways leading to the said bridge and equal privileges in th use of said bridge shall be granted to all telegraph companies. The United Stat shall have also the right of way over said bridge for postal-telegraph purposes.

SEC. 5. That all railway companies desiring to use said bridge shall be entitled t equal rights and privileges in using the same, of the machinery and fixtures thereto belonging, and also of the approaches thereto, upon such terms and conditions as shall be prescribed by the Secretary of War upon hearing the allegations and proofs of the parties in interest, in case the parties in interest shall not be able to agree upon such terms and conditions.

SEC. 6. That the said railway company before entering upon the construction of such bridge shall submit to the Secretary of War plans and drawings of such structure, together with a map of the location thereof, for one mile above and one mile below said location, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the current of said river at all stages of water, showing also the bed of the river and the channel, with such other and further information as the Secretary of War may require, which said drawings and other information aforesaid shall be examined by him, and if he shall approve the same, he shall so notify the said railway company of such approval, and said company may then proceed to the erection of said bridge. The Secretary of War may make such alterations in such plans as he may deem necessary to the better protection of navigation; and such alterations shall be adopted by said railway company. The said railway company may, at any time, make any alterations deemed advisable to be made in said bridge, but must first submit such proposed alterations to the Secretary of War, and his approval shall be first had before they shall be authorized; and all expense attending any such changes shall be paid by the company.

SEC. 7. That the said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels under it both by day and night. There shall be displayed on said bridge from sunset to sunrise such lights and signals as may be directed by the Secretary of War. And such changes may be made from time to time in the structure of said bridge as the Secretary of War may direct at the expense of said railway, in order the more effectually to preserve the free navigation of said river; or the said structure shall be altogether removed, if in the judgment of the Secretary of War, the public good may require such removal, and without expense or charge to the United States.

SEC. 8. That this act shall be null and void, unless actual construction of the bridge herein authorized be commenced within one year and completed within three years from the date of this act being approved.

SEC. 9. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Received by the President July 5, 1888.

[NOTE BY THE DEPARTMENT OF STATE.—The foregoing act having been presented to the President of the United States for his approval, and not having been returned by him to the house of Congress in which it originated within the time prescribed by the Constitution of the United States, has become a law without his approval.]

AN ACT making appropriations to provide for the expenses of the government of the District of Columbia for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the half of the following sums named, respectively, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, and the other half out of the revenues of the District of Columbia, for the purposes following, being the estimated expenses of the government of the District of Columbia for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, namely:

FOR SALARIES AND CONTINGENT EXPENSES.

FOR EXECUTIVE OFFICE: For * * * one Engineer Commissioner, nine hundred and twenty-four dollars (to make salary five thousand dollars).

* * * * * * *

WASHINGTON AQUEDUCT.

For engineering, maintenance, and general repairs, twenty thousand dollars.

* * * * * * *

Approved, July 18, 1888.

AN ACT authorizing the Mississippi and Louisiana Bridge and Railroad Company of Natchez, Mississippi, to construct a bridge over the Mississippi River at or near Natchez, Mississippi.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Mississippi and Louisiana Bridge and Railroad Company of Natchez, Mississippi, a corporation duly incorporated under the laws of the State of Mississippi, be, and they are hereby, authorized to construct, maintain, and use a railroad bridge over the Mississippi River at or near Natchez at such point selected by them as the most suitable.

SEC. 2. That said bridge may be constructed of continuous, unbroken spans, or as a cantilever or suspension bridge, or a combination of these systems, together with such improvements as science and practical experience may suggest and as shall be deemed best, and to cross said river at right angles to the current thereof, and to be supported on iron cylinders filled with concrete or other material, with a superstructure of masonry or iron piling, or a combination of masonry and iron piling, or such other approved modes of support for the superstructure as may be deemed best.

SEC. 3. That the main channel-span shall not be less than seven hundred feet wide in the clear, to be placed at right angles to the direction of the current, and that the spans on either side of and next to the main span shall not be less than six hundred feet in clear width, and that the height in the clear of the spans and the location of the piers shall be approved by the Secretary of War before the bridge is constructed: *Provided*, That the height of said span shall not be less than seventy-five feet.

SEC. 4. That the piers of the spans shall be built parallel with the current at that stage of the river, and that no ripraps will be permitted in the channel-way of the openings.

SEC. 5. That said Mississippi and Louisiana Bridge and Railroad Company shall give due notice by publication for one week in one or more of the newspapers in the cities of Pittsburgh, Cincinnati, Louisville, Saint Louis, Memphis, Natchez, and New Orleans, and shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge and piers, and the map of the location, giving, for the space of three thousand feet both above and below the site of the proposed bridge, the topography of the banks of the river, and the shore-lines at high and low water. There shall also accompany the maps or drawings a profile of the bottom of the river for one thousand feet above and below the site of the proposed bridge, from the soundings as made by the United States Engineers of the Mississippi River Commission, or by its own engineers, and also to show accurately at the crossing point and location of the piers an exact profile, and also to show over the whole space of one thousand feet above and below the location of the proposed bridge the force and direction of the currents at low water, at high water, and at one intermediate stage, and the highest and lowest water-mark for the years eighteen hundred and eighty-two, eighteen hundred and eighty-three, eighteen hundred and eighty-four and eighteen hundred and eighty-five, at Natchez, Mississippi.

SEC. 6. That said maps and drawings shall be submitted to the Secretary of War, with such other information as he may desire, subject to such modifications, changes, or improvements as may be suggested by him.

SEC. 7. That the maps and drawings shall be open to public inspection at the office of the Secretary of War, and a duplicate thereof at the office of the Mississippi and Louisiana Bridge and Railroad Company, at Natchez, Mississippi, of which due notice shall be given by publication in one or more of the newspapers in the cities of New York, Washington, Philadelphia, Baltimore, Pittsburgh, Cincinnati, Louisville, Saint Louis, Memphis, Natchez, and New Orleans.

SEC. 8. That all parties owning or operating said bridge shall maintain, at their own expense, from sunset to sunrise, such lights on said bridge as may be required by the Light-House Board for security of navigation, and shall, in any event, maintain all lights necessary for the security of navigation.

SEC. 9. That the bridge constructed under this act shall be a lawful structure, and shall be known and recognized as a post-route for the transmission of mails, military, and munitions of war of the United States, as well as all merchandise and property; and in case of any unlawful obstruction of said river created by the construction of said bridge, the cause or question arising may be tried before the circuit court of the United States for Mississippi or Louisiana, in whose jurisdiction any portion of said obstruction or bridge is located; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 10. That the bridge hereby authorized may be constructed for the passage of wagons and other vehicles, and of foot-passengers, or animals of any description, but the rates of toll therefor shall be approved by the Secretary of War, and may be fixed by him from time to time at such reasonable amounts as he may determine; and all railroad companies wishing to use said bridge for the passage of their trains shall have the right, on such terms as may be agreed upon between the owners of said bridge and the companies or persons applying to use the same; and if any disagreement shall arise between the parties as to the terms, the same shall be finally determined by the Secretary of War.

SEC. 11. That the right to alter, amend, or repeal this act is hereby expressly reserved; and if the Secretary of War shall at any time deem it necessary in the public interest to cause said bridge, or any part thereof, to be altered in any respect, the same shall be done at the cost of the parties owning or controlling said bridge; and any litigation in regard to said bridge may be had in the circuit court of the United States for Mississippi or Louisiana, within whose jurisdiction the bridge, or any part thereof, is located.

SEC. 12. That if the construction of said bridge is not commenced in two years from the passage of this act, and completed in five years thereafter, all rights hereby conferred shall cease and determine.

Approved, July 19, 1888.

AN ACT authorizing the construction of a bridge across Flint River in the State of Georgia.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the Americus, Preston, and Lumpkin Railroad Company, an organization incorporated under the laws of the State of Georgia, its successors and assigns, to construct and maintain a bridge over Flint River, in the State of Georgia.

SEC. 2. That said bridge shall be a draw-bridge, to consist of two spans of forty feet on each side, and a draw of one hundred and eighty-four feet in the centre of the stream; the spans shall not be less than thirty-eight feet above low-water mark: *Provided*, That if said bridge shall, in the opinion of the Secretary of War, obstruct the navigation of said river, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such obstructions shall be removed, and alterations made at the expense of the owner or owners of said bridge.

SEC. 3. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over said bridges, than the rate per mile paid for the transportation over the railroads or public highways leading to said bridges; and they shall enjoy the rights and privileges of other post-roads of the United States. And equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge and its approaches for said postal telegraph purposes.

SEC. 4. That said bridge shall be built and located under and subject to such regulations for the security of navigation of said rivers as the Secretary of War shall prescribe; and to secure that object said company or corporation shall submit to the Secretary of War a design and drawing of said bridge, for his examination and approval, and a map of its location, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and in all things shall be subject to said rules and regulations as may be prescribed by the Secretary of War; and until said plan and location of said bridge are approved by the Secretary of War the construction of said bridge shall not be commenced; and should any change be made in the plan of said bridge, during the progress of the work of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 5. That this act shall be null and void if actual construction of the bridge therein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require any changes in said structure, or its removal, at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interest requires it, is also expressly reserved.

Approved, July 19, 1888.

AN ACT to authorize the building of a railroad bridge at Fort Smith, Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Fort Smith, Paris and Dardanelle Railway Company, a corporation organized under the laws of the State of Arkansas, to construct and maintain a bridge, and approaches thereto, over the Arkansas River, at a point on said river at or near the city of Fort Smith, in the state of Arkansas, and to lay on and over said bridge a railroad track or tracks for the more perfect connection of any railroad or railroads that are or shall hereafter be constructed to the said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided; said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the builders and owners thereof, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals of all kinds, and for foot-passengers for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, troops, and the munitions of war, or other property of the United States, than the rate per mile paid for the transportation of the same over the railroads or public highways leading to the said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States. Equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 3. That the said bridge shall be constructed with a draw or pivot span which shall be over the main channel of the river at an accessible navigable point, and the openings on each side of the pivot pier shall not be less than one hundred and sixty feet in the clear, and, as nearly as practicable, both of said openings shall be accessible at all stages of water; that the spans be not less than ten feet above extreme high-water mark, as understood at the point of location, to the lowest point of the superstructure of said bridge; that the piers and draw rests of said bridge shall be built parallel with the current at that stage of the river which is most important for navigation, and the bridge itself at right angles thereto; and that no riprap or other outside protection for imperfect foundations be permitted to approach nearer than four feet to the surface of the water at its extreme low stage, or otherwise to encroach upon the channel-ways provided for in this act: *Provided*, That said draw shall be opened by the company or persons owning said bridge upon reasonable signal for the passage of boats; and there shall be maintained, at the expense of the owners thereof, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 4. That all railroad companies desiring the use of said bridge shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains over the same, and over the approaches to the same, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions which each shall perform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to the regulations for the security of said river as the Secretary of War shall prescribe; and to secure that object the owner or owners thereof shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-line at high or low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for the full and satisfactory understanding of the subject; and until such plan and location of the bridge are approved by the Secretary of War, the bridge shall not be commenced or built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interests requires it, is also expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof. And if any litigation shall arise in regard to said bridge under the provisions of this act, the same shall be had in the circuit court of the United States in whose jurisdiction the bridge or any part thereof is located.

Approved, July 19, 1888.

AN ACT to authorize the construction of a bridge across the Missouri River between Clay County and Jackson County, Missouri, at a point to be selected consistent with the interests of river navigation between Kansas City, Missouri, and a point within five miles below said city.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Randolph and Kansas City Bridge Company, a corporation duly created and existing under and by virtue of the laws of the State of Missouri, its successors or assigns, be, and are hereby, authorized to construct and maintain a bridge and approaches thereto across the Missouri River, between Clay County and Jackson County, in the State of Missouri, at some point at least one-fourth of a mile from any other bridge, to be selected consistent with the interests of river navigation between Kansas City, Missouri, and a point within five miles below said city. Said bridge shall be constructed to provide for the passage of railway trains, wagons, and vehicles of all kinds, steam and street cars, animals, foot-passengers, and for all road travel, for such reasonable rates of toll and under such reasonable rules and regulations as may be prescribed by said corporation, its successors or assigns, and be approved from time to time by the Secretary of War.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 3. That said bridge shall be constructed as a ponton draw-span bridge, and shall contain a ponton draw-span of not less than four hundred feet in length, which draw-span shall be maintained over the main channel of the river at an accessible and navigable point, and the piers of said bridge shall be paralled with, and the bridge itself at right angles to, the current of the river: *Provided, also*, That said draw shall be opened promptly by said company, upon reasonable signal for the passage of boats or rafts, and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said river, and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, caused or alleged to be caused by said bridge, the case may be brought in the district court of the United States of the State of Missouri in which any portion of said obstruction or bridge may be located: *Provided further*, That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt this bridge from the operation of the same.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one-half mile above and one-half mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved. And the right to require any changes in said structure or its entire removal, at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interest requires it, is also expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, July 23, 1888.

AN ACT to authorize the construction of a bridge across the Arkansas River at or near Cumming Landing, Lincoln County, Arkansas.

Be it enacted by the Senate and House of Representatives of the United States of Americ in Congress assembled, That it shall be lawful for the Kansas City, Arkansas and New Orleans Railway, a corporation organized, chartered, and duly perfected under and in full accordance with the statutes of the State of Arkansas, or its successors or assigns, to construct and maintain a bridge, and approaches thereto, over the Arkansas River, at a point on said river at or near Cummings' Landing, Lincoln County, in the State of Arkansas, and to lay on and over said bridge a railroad track or tracks for the more perfect connection of any railroad or railroads that are or shall hereafter be constructed to the said river, on either or both sides thereof, at or opposite said point, under the limitations and conditions hereinafter provided; said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the builders and owners thereof, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals of all kinds, and for foot-passengers for such reasonable rates of toll as may be approved from time to time by the Secretary of War as to railway trains; and as to wagons, vehicles, animals and foot-passengers such rates as may be provided by the laws of the State of Arkansas.

SEC. 2. That any bridge built under this act is subject to its limitations, shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, troops, and the munitions of war, or other property of the United States, than the rate per mile paid for the transportation of the same over the railroad or public highways leading to the said bridge, and it shall enjoy the rights and privileges of other post-roads in the United States. Equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 3. That said bridge shall be constructed with a draw or pivot-span, which shall be over the main channel of the river, at an accessible navigable point, and the openings on each side of the pivot-pier shall be of such width as the Secretary of War shall prescribe, and as nearly as practicable, both of said openings shall be accessible at all stages of water; that the spans shall be of such height above extreme high-water mark, as understood at the point of location, to the lowest point of the superstructure of said bridge as may be directed by the Secretary of War in the interests of navigation; that the piers and draw rests on said bridge shall be built parallel with the current at that stage of the river which is most important for navigation, and the bridge itself at right angles thereto; and that no riprap or other outside protection for imperfect foundations be permitted to approach nearer than four feet to the surface of the water at its extreme low stage, or otherwise to encroach upon the channel-ways provided for in this act: *Provided*, That said draw shall be opened by the company or persons owning said bridge upon reasonable signal for the passage of boats; and there shall be maintained, at the expense of the owners thereof, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe.

SEC. 4. That all railroad companies desiring the use of said bridge shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains over the same, and over the approaches to the same, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions which each shall perform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built and located under and subject to the regulations for the security of said river as the Secretary of War shall prescribe; and to secure that object the owner or owners thereof shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-line at high or low water, the direction and strength of the currents at all stages, and the soundings, actually showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for the full and satisfactory understanding of the subject; and until such plan and location of the bridge are approved by the Secretary of War, the bridge shall not be commenced or built, and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved, and the right to require any changes in said structure, or its entire removal at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interest requires it, is also expressly reserved.

Sec. 7. That this act shall be null and void if actual construction of the bridge erein authorized be not commenced within eighteen months and completed within ur years from the date thereof.

Approved, July 24, 1888.

N ACT to authorize the building of a bridge across the Mississippi River at Wabasha, Minnesota.

Be it enacted by the Senate and House of Representatives of the United States of America Congress assembled, That the city of Wabasha, in the State of Minnesota, be, and hereby, authorized to construct and maintain a bridge for the passage of vehicles f all kinds, animals, and foot-passengers, across that part of the Mississippi River ast of the main channel of said river, at a point opposite or nearly opposite the id city of Wabasha, and to charge for such use such reasonable rates of toll as ay be approved from time to time by the Secretary of War.

Sec. 2. That any bridge constructed under this act and according to its limitations all be a lawful structure, and shall be recognized and known as a post-route, upon hich also no higher charge shall be made for the transmission over the same for the ails, the troops, and the munitions of war of the United States than the rate per ile paid for their transportation over railroads or public highways leading to said ridge; and the United States and all companies and individuals shall have the right f way for telegraph, postal-telegraph, and telephone purposes across said bridge.

Sec. 3. That any bridge authorized to be constructed under this act shall be built nd located under and subject to such regulations for the security of navigation of aid river as the Secretary of War shall prescribe; and to secure that object the said ompany or corporation shall submit to the Secretary of War, for his examination nd approval, a design and drawings of the bridge, and a map of the location, giving, or the space of one mile above and one mile below the proposed location, the topog-aphy of the banks of the river, the shore-lines at high and low water, the direction nd strength of the current at all stages, and the soundings, accurately showing the ed of the stream, the location of any other bridge or bridges, and shall furnish such ther information as may be required for a full and satisfactory understanding of the ubject; and until the said plan and location of the bridge are approved by the Sec-etary of War the construction of said bridge shall not be commenced; and should ny change be made in the plan of said bridge during the progress of construction, uch change shall be subject to the approval of the Secretary of War; and in case of ny litigation arising from any obstruction or alleged obstruction to the free naviga-ion of said river, caused or alleged to be caused by said bridge, the case may be rought in the circuit court of the United States within whose jurisdiction said ridge or any portion thereof may be located.

Sec. 4. That the right to alter, amend, or repeal this act is hereby expressly re-erved, and the right to require any changes in said structure, or its entire removal, t the expense of the owners thereof, whenever the Secretary of War shall decide hat the public interest requires it, is also expressly reserved.

Sec. 5. That this act shall be null and void if actual construction of the bridge erein authorized be not commenced within one year and completed within three ears from the date hereof.

Approved, July 24, 1888.

N ACT to authorize the construction of a railroad, wagon, and foot-passenger bridge across the Mississippi River at or near Burlington, in the State of Iowa.

Be it enacted by the Senate and House of Representatives of the United States of America Congress, assembled, That the Burlington and Illinois Bridge Company, its successors nd assigns be, and they are hereby, authorized to construct and maintain, if in the pinion of the Secretary of War the same be a public necessity, a railroad, wagon, and ot-passenger bridge across the Mississippi River at a place suitable to the interest of avigation, at a point at or near the city of Burlington, Iowa, and to lay on or over id bridge a railroad track or tracks for the more perfect connection of any railroad railroads that are or shall be constructed to said river, on either or both sides hereof at or opposite said point, under the limitations and conditions hereinafter rovided; that said bridge shall not interfere with the free navigation of said river eyond what is necessary in order to carry into effect the rights and privileges hereby ranted; and in case of any litigation arising from any obstruction or alleged obstruc-on to the free navigation of said river, the cause may be tried before the circuit ourt of the United States in and for any district in which any portion of said bridge obstruction is located. Said bridge shall be constructed to provide for the passage

of railroad trains, and for the safe and convenient passage of wagons and vehic
all kinds, animals, and foot-passengers, for such reasonable rates of toll as ma
fixed from time to time by the Secretary of War.

Sec. 2. That any bridge built under the provisions of this act, may, at the op
of the company building the same, be built as a draw-bridge or with unbroken
continuous spans: *Provided*, That if the said bridge shall be made with unbroken
continuous spans, it shall give clear headroom of not less, in any case, than fift
and one-half feet above extreme high-water mark, as understood at the point of
tion; nor shall the spans of said bridge give a clear width of water-way of less
two hundred and fifty feet, and the piers of said bridge shall be parallel with
current of said river, and the main span shall be over the main channel of the
and give a clear width of water-way of not less than three hundred feet: *And*
vided further, That if any bridge built under the provisions of this act shall be
structed as a draw-bridge, the same shall be constructed as a pivot draw-bridge,
a pivot over the main channel of the river at an accessible and navigable point,
with spans giving a clear width of water-way of not less than two hundred fe
each side of the central or pivot pier of the draw, and the next adjoining spa
spans to the draw shall give a clear width of water-way of not less than two hu
and fifty feet: *Provided*, That if the pivot pier of said bridge shall be constru
within less than four hundred and ten feet of the west shore of said river, the
constructed west of said pivot pier may be less than two hundred and fifty feet,
said spans shall give a clear head-room of not less than ten feet above extreme
water mark; and the piers of said bridge shall be parallel with the current of
river where said bridge shall be erected: *And provided also*, That said draw sha
opened promptly upon reasonable signal for the passage of boats, except when
are passing over the draw; but in no case shall unnecessary delay occur in ope
the said draw during or after the passage of trains. And such lights and sign
shall be placed upon said bridge when constructed as the Light House Board re
quire.

Sec. 3. That any bridge constructed under this act and according to its limit
shall be a lawful structure, and shall be known as a post route, and the same is
by declared to be a post route upon which also no higher charge shall be ma
the transportation over the same of the mails, the troops, and the munitions of
the United States, and for passengers or freight passing over said bridge tha
rate per mile paid for their transportation over the railroads and public hig
leading to said bridge; and the United States shall have the right of way for p
telegraph purposes across said bridge.

Sec. 4. That all railway companies desiring to use said bridge shall have a
entitled to equal rights and privileges in the passage of the same, and in the
the machinery and fixtures thereof, and of all the approaches thereto, unde
upon such terms and conditions as shall be prescribed by the Secretary of War,
hearing the allegations and proofs of the parties, in case they shall not agree.

Sec. 5. That the structure herein authorized shall be built and located unde
subject to such regulations for the security of the navigation of said river
Secretary of War shall prescribe; and to secure that object the said company
poration shall submit to the Secretary of War, for his examination and appro
design and drawing of the bridge and a map of the location, giving for the sp
one mile above and one mile below the proposed location the topography of the
of the river, the shore-line at high and low water, the direction and strength
current at all stages, and the soundings, accurately showing the bed of the s
the location of any other bridge or bridges, and shall furnish such other infor
as shall be required for a full and satisfactory understanding of the subject:
until the said plan and location of the bridge are decided by the Secretary of
be such as will not affect the interests of navigation, the bridge shall not be
menced or built, and should any change be made in the plan of said bridge
the progress of construction, such change shall be subject to the approval of the
retary of War; and the said bridge shall be constructed with such aids to the p
of said bridge, in the form of booms, dikes, piers, or other suitable and proper
ures for confining the flow of water to a permanent and easily navigated ch
for a distance of not less than one mile above the bridge location, and for the
ing of rafts, steamboats, and other water craft safely through the draw and raft
as the Secretary of War shall prescribe, and order to be constructed and main
at the expense of the company owning said bridge, and the said structure shal
all times so kept and managed as to offer reasonable and proper means for the p
of vessels through or under said structures; and for the safety of vessels pas
night there shall be displayed on said bridge, from the hours of sunset to
such lights as may be prescribed by the Light House Board; and the said str
may be changed or removed at the cost and expense of the owners thereof,
Secretary of War may direct, so as to preserve the free and convenient naviga
said river; and the authority to erect and continue said bridge shall be subject

vocation and modification by law, when the public good shall, in the judgment of Congress, so require, without any expense or charge to the United States.

SEC. 6. That if actual construction of the bridge herein authorized shall not be commenced within two years from the passage of this act, and be completed in four years from the same date, the rights and privileges hereby granted shall cease and be determined.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, August 6, 1888.

AN ACT authorizing the erection of a bridge across the Missouri River at Ponca, Nebraska.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Nebraska and Dakota Bridge Company, a corporation organized under the laws of Nebraska, or its successors or assigns, to construct, under and subject to the conditions and limitations hereinafter provided, a bridge across the Missouri River at or near Ponca City, Nebraska, and ay on or over said bridge railway tracks for the more perfect connection of any and all railways that now are or which may hereafter be constructed to the Missouri River at or near Ponca City, or to the river on the opposite of the same near Ponca City, and build, erect, and lay on and over said bridge ways for wagons and vehicles of all kinds, and for the transit of animals, and to keep up and maintain and operate said bridge for the purposes aforesaid; and that when said bridge is constructed all trains of all railroads terminating at said river and on the opposite side thereof, at or near Ponca City, Nebraska, shall be allowed to cross said bridge for reasonable compensation to be made to the owners of the same under the conditions and limitations hereinafter named.

The owners of said bridge may also charge and receive reasonable compensation or tolls for the transit over said bridge of all wagons, carriages, vehicles, animals, and foot-passengers: *Provided,* That the Secretary of War, may at any time prescribe such rules, regulations and rates of toll for transit and transportation over said bridge as may be deemed proper and reasonable.

SEC. 2. That any bridge built under the provisions of this act, shall be built as a high bridge, with unbroken and continuous spans, all spans over the water-way to have a clear channel-way of not less than three hundred feet and a clear head-room of not less than fifty feet above high-water mark, and the piers of said bridge shall be parallel with the current of the river and the bridge itself at right angles thereto: *Provided,* That the person or persons or corporation building said bridge, may, subject to the approval of the Secretary of War, enter upon the banks of said river either above or below the point of location of said bridge and confine the flow of the water to a permanent channel, and to do whatever may be necessary to accomplish said objects, but shall not impede or obstruct the navigation of said river, and shall be liable in damages for all injuries to private property; and all plans for such work or erections upon the banks of the river shall first be submitted to the Secretary of War for his approval.

SEC. 3. That no bridge shall be erected or maintained under the authority of this act which shall at any time obstruct the free navigation of said river; and no bridge shall be commenced or built under this act until the location thereof and the plans and specifications for its construction shall have been submitted to and approved by the Secretary of War; and any change in the plan of such construction, or any alteration in the bridge after its construction, shall be subject to the like approval.

And whenever said bridge shall, in the opinion of the Secretary of War, substantially obstruct the free navigation of said river, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction, or its entire removal; and all such alterations shall be made and such obstructions be removed at the expense of the owners of said bridge; and in case of any litigation arising from any obstruction, or alleged obstruction, to the free navigation of the Missouri River at or near the crossing of said bridge, caused or alleged to be caused, thereby, the case shall be commenced and tried in the district courts of either judicial district of Nebraska or Dakota Territory in which said bridge or any portion of such obstruction touches.

SEC. 4. That any bridge built under this act, and according to its limitations, shall be a lawful structure and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transportation over the same of the mails, the troops and munitions of war, of the United States than the rate per mile paid for their transportation over the railroads or public highway leading to such bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes. Such lights shall be kept upon said bridge as the Light-

House Board shall direct, and said bridge shall moreover be provided with all safeguards for the security of person and property.

SEC. 5. That this act shall be null and void if actual construction of the herein authorized be not commenced within one year and completed within years from the date thereof.

SEC. 6. That Congress may at any time alter, amend, or repeal this act.

Approved, August 6, 1888.

AN ACT to authorize the construction of a bridge across the Missouri River in Monta

Be it enacted by the Senate and House of Representatives of the United States of in Congress assembled, That the Benton Bridge Company, a corporation existing the laws of the Territory of Montana, and having authority to construct and tain a bridge across the Missouri River at or near Fort Benton, in the county of teau in said Territory, be, and is hereby, authorized to construct and maintain, the purpose of making a more perfect crossing of said river at all times during year, a bridge across the said Missouri River at or near said Fort Benton, to be by the said company, its successors or assigns, for all purposes of rail and transportation over said river.

SEC. 2. That any bridge built under this act shall be constructed and built material interference with the security and convenience of navigation of said beyond what is necessary to carry into effect the rights and privileges hereby gra And in order to secure that object the said company or corporation shall sub the Secretary of War, for his examination and approval, a design and drawing the bridge and of all accessory works for its protection, and a map of the loca for the space of one-half mile above and the same below the proposed location, ing the topography of the banks of the river, the shore-line at high and low the direction and strength of the current at all stages, and the soundings, rately showing the bed of the stream, and shall furnish such other information as be required for a full and satisfactory understanding of the subject; and until said plan and location of the bridge are approved by the Secretary of War building of the bridge shall not be commenced; that the said bridge shall be at angles to and the piers parallel with the current of said river; and if it be hereafter that the said bridge or accessory works materially interfere with the curity and convenience of navigation of said river beyond what is necessary to into effect the rights and privileges hereby granted, by reason of any defect or in the accessory works aforesaid to accomplish the purpose for which they are signed, it shall be the duty of the Secretary of War to require the necessary cha to be made therein in the interest of navigation, at the expense of the owners: *vided,* That as to any bridge built under this act, if the said bridge shall be buil unbroken and continuous spans, it shall not be of less elevation in any case than feet above extreme high-water mark, as understood at the point of location, to lowest part of the superstructure of the bridge, nor shall the spans of said bridge less than one hundred and twenty feet in length, clear of the piers, and the spans shall be over the main channel of the river: *And provided also,* That if bridge built under the provisions of this act shall be constructed as a draw brid the same shall be constructed as a pivot draw bridge, with a draw over the channel of the river at an accessible and navigable point, and with spans at any not less than ten feet above extreme high-water mark at the point of location, not less than sixty feet on each side of the central or pivot pier of the draw; and next adjoining spans shall be not less than one hundred and twenty feet in leng *Provided, also,* That said draw shall be opened promptly upon reasonable signal for passing of boats; and said company or corporation shall maintain, at its own exp from sunset to sunrise, such lights and other signals on said bridge as the Light-Ho Board may prescribe: *Provided, also,* That all railway companies desiring to use bridge shall have, and be entitled to, equal rights and privileges in the passage same, and in the use of the machinery and fixtures thereof, and of all the appro thereto, under and upon such terms and conditions as shall be prescribed by the retary of War upon hearing the allegations and proofs of the parties in case the shall not agree. The owners of said bridge may also charge and receive reaso compensation or tolls for the transit over said bridge of all wagons, carriages, cles, animals, and foot passengers: *Provided,* That the Secretary of War may at time prescribe such rules, regulations, and rates of toll for transit and transporta over said bridge as may be deemed proper and reasonable.

SEC. 3. That any bridge and accessory works, when built and constructed this act and according to the terms and limitations thereof, shall be a lawful ure, and said bridge shall be recognized and known as a post-route upon which no higher charge shall be made for the transmission over the same of the mails, ps, and munitions of war of the United States, than the rate per mile paid for transportation over the railroads or public highways leading to said bridge; and bridge shall enjoy the rights and privileges of other post-routes in the United es, and Congress reserves the right to regulate by appropriate legislation the rges for freight and passengers over said bridge.

ec. 4. That equal privileges in the use of said bridge shall be granted to all tele- ph companies, and the United States shall have the right of way for postal tele- ph across said bridge.

ec. 5. That the right to alter, amend. or repeal this act is hereby expressly re- ed, and the right to require any changes in the said structure or its entire re- al at the expense of the owners thereof whenever the Secretary of War shall de- that the public interests require it is also expressly reserved.

c. 6. That this act shall be null and void if actual construction of the bridge in authorized be not commenced within one year and completed within three s from the date thereof.

pproved, August 6, 1888.

ACT authorizing the construction of a bridge across the Ocmulgee River, in the State of Georgia, and for other purposes.

it enacted by the Senate and House of Representatives of the United States of America ongress assembled, That the assent of Congress is hereby given to the Americus ton and Lumpkin Railroad Company, an organization incorporated under the of the State of Georgia, its successors or assigns, to construct and maintain a ge over the Ocmulgee River, in the State of Georgia.

c. 2. That said bridge shall be constructed as a draw-bridge, and shall consist of span of seventy-five feet and a draw-span of one hundred and eighty-four feet. spans shall not be less than twenty-eight feet above low water mark: *Provided,* if said bridge shall, in the opinion of the Secretary of War, obstruct the navi- on of said stream, he is hereby authorized to cause such change or alteration of bridge to be made as will effectually obviate such obstruction; and all such ob- ctions shall be removed and alterations made at the expense of the owner or ers of said bridge.

c. 3. That any bridge built under this act and subject to its limitations shall be vful structure, and shall be recognized and known as a post-route, upon which no higher charge shall be made for the transmission over the same of the mails, roops, and the munitions of war of the United States, or passengers or freight ng over said bridges, than the rate per mile paid for the transportation over the oads or public highways leading to said bridges; and they shall enjoy the rights privileges of other post-routes of the United States. And equal privileges in the f said bridge shall be granted to all telegraph companies, and the United States have the right of way across said bridge and its approaches for said postal-tele- h purposes.

c. 4. That said bridge shall be built and located under and subject to such regu- ns for the security of navigation of said rivers as the Secretary of War shall pre- e; and to secure that object said company or corporation shall submit to the etary of War a design and drawings of said bridge, for his examination and ap- al, and a map of its location, and shall furnish such other information as may be ired for a full and satisfactory understanding of the subject, and in all things be subject to such rules and regulations as may be prescribed by the Secretary of ; and until said plan and location of said bridge are approved by the Secretary of the building of said bridge shall not be commenced; and should any change ade in the plan of said bridge, during the progress of the work of construction, change shall be subject to the approval of the Secretary of War.

c. 5. That this act shall be null and void if actual construction of the bridge n authorized be not commenced within one year and completed within three from the date thereof.

c. 6. That the right to alter, amend, or repeal this act is hereby expressly re- d; and the right to require any changes in said structure, or its removal, at the nse of the owners thereof, whenever Secretary of War shall decide that the pub- terest requires it, is also expressly reserved.

proved, August 6, 1888.

CT to authorize the construction of a bridge across the Missouri River at Forest City, Dakota, by the Forest City and Watertown Railway Company.

it enacted by the Senate and House of Representatives of the United States of America ngress assembled, That the Forest City and Watertown Railway Company, a corporation duly organized under the general incorporation laws of the Territory Dakota, its successors and assigns, is hereby authorized to construct and mainta a bridge across the Missouri River at or near Forest City, Potter County, Dakota, an also to lay on and over such bridge a railway track or tracks for the passage of rai way trains; and said corporation may construct and maintain ways for wagons, car riages, and foot-passengers, charging and receiving such reasonable tolls therefor a may be approved from time to time by the Secretary of War.

SEC. 2. That said bridge shall be constructed and built without interference wit the security and convenience of navigation of said river beyond what is necessary t carry into effect the rights and privileges hereby granted; and in order to secure th object the said corporation shall submit to the Secretary of War, for his examinatio and approval, a design and drawings of the bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topogra phy of the banks of the river, the shore lines at high and low water, the direction an strength of the currents at all stages, and the soundings, accurately showing the bed o the stream, the location of any other bridge or bridges, and shall furnish such othe information as may be required for a full and satisfactory understanding of the sub ject; and until the said plan and location of the bridge are approved by the Secre tary of War the bridge shall not be built: *Provided*, That if the said bridge shall b made with unbroken and continuous spans, it shall not be of less elevation in an case than fifty feet above extreme high-water mark, as understood at the point of l cation, to be the lowest part of the superstructure of the bridge, nor shall the spa of said bridge be less than three hundred feet in length, and the piers of said brid shall be parallel with the current of said river, and the bridge itself at right ang thereto, and the main span shall be over the main channel of the river and not le than three hundred feet in length: *And provided, also*, That if any bridge built und this act shall be constructed as a draw-bridge, the same shall be constructed as pivot draw-bridge, with a draw over the main channel of the river at an accessib and navigable point, and with spans of not less than one hundred and sixty feet i length in the clear on each side of the central or pivot pier of the draw, and the ne adjoining span or spans to the draw shall not be less than three hundred feet, an the head-room under such span shall not be less than ten feet above local high-wa mark: *Provided, also*, That said draw shall be opened promptly upon reasonable si nal for the passing of boats; and said company or corporation shall maintain, at it own expense, from sunset till sunrise, such lights or other signals on said bridge a the Light-House Board shall prescribe: *Provided, also*, That all railway companies d siring to use said bridge shall have and be entitled to equal rights and privileges i the passage of the same, and in the use of the machinery and fixtures thereof, an of all the approaches thereto, under and upon such terms and conditions as sha be prescribed by the Secretary of War, upon hearing the allegations and proofs o the parties, in case they shall not agree.

SEC. 3. That the Secretary of War is hereby authorized and directed, upon recei ing such plan and map and other information, and upon being satisfied that th bridge built upon such plan, with such accessory works, and at such locality, wi conform to the prescribed conditions of this act, to notify the company that he a proves the same, and upon receiving such notification the said company may proce to an erection of said bridge, conforming strictly to the approved plan and locatio and should any change be made in the plan of the bridge or accessory works du ing the progress of the work thereon such change shall be subject likewise to the a proval of the Secretary of War; and in case of any litigation arising from any o struction or alleged obstruction to the free navigation of said river, caused or alleg to be caused by said bridge, the case may be brought in any circuit court of th United States or any district court of the Territory of Dakota, within whose jurisdi tion any portion of said bridge may be located.

SEC. 4. That the said bridge and accessory works, when built and constructed und this act, and according to the terms and limitations thereof, shall be lawful struct ures; and said bridge shall be recognized and known as a post-route, upon whi also no higher charge shall be made for the transmission over the same of the mail the troops, and the munitions of war of the United States than the rate per mile pa for the transportation over the railroads or public highways leading to such bridg and said bridge shall enjoy the rights and privileges of other post-routes in the Unit States; and equal privileges in the use of said bridge shall be granted to all tel graph companies; and the United States shall have the right of way across sa bridge and its approaches for postal telegraph purposes.

SEC. 5. That all railroad companies desiring the use of the bridge constructed u der this act shall have, and be entitled to, equal rights, and privileges, relative t the passage of railway trains, cars, and locomotives over the same and over the a proaches thereto, upon the payment of a reasonable compensation for such use; an in case the owner or owners of the said bridge and the several railroad companies, o any of them, desiring such use shall fail to agree upon the sum or sums to be pa

d upon rules and conditions to which each shall conform in using said bridge, all
ch matters of difference between them shall be decided by the Secretary of War
on a hearing of the allegations and proofs of the parties.

Sec. 6. That the right to alter, amend, or repeal this act is hereby expressly re-
rved; and the right to require any changes in said structure, or its entire removal,
; the expense of the owners thereof, whenever the Secretary of War shall decide
at the public interest requires it, is also expressly reserved.

Sec. 7. That this act shall be null and void if actual construction of the bridge herein
thorized be not commenced within one year and completed within three years from
e date thereof.

Approved, August 6, 1888.

N ACT granting to the Aberdeen, Bismarck and Northwestern Railway Company the right to construct and maintain a bridge across the Missouri River, near Winona, Emmons County Dakota.

Be it enacted by the Senate and House of Representatives of the United States of America
Congress assembled, That the Aberdeen, Bismarck and Northwestern Railway Com-
any, a corporation organized under the laws of the Territory of Dakota, is hereby au-
horized to construct and maintain a bridge across the Missouri River, at such point
s may be hereafter selected by said corporation, within ten miles of Winona, Emmons
ounty, Dakota, due regard being had to the public convenience and welfare and
o the necessities of business and commerce; and also to construct accessory works to
ecure the best practical channel-way for navigation and to confine the flow of the
vater to a permanent channel at such point; and also to lay on and over such bridge
, railway track, for the more perfect connection of any railroads that are or shall be
onstructed to said river at or opposite said point; and said corporation may construct
nd maintain ways for wagons, carriages, and for foot-passengers, charging and re-
eiving reasonable toll therefor, as may be approved from time to time by the Secre-
ary of War.

Sec. 2. That the said bridge shall be constructed without interference with the
ecurity and convenience of navigation of said river beyond what is necessary to
arry into effect the rights and privileges hereby granted; and in order to secure that
bject the said corporation shall submit to the Secretary of War, for his examination
nd approval, a design of and drawings for said bridge, and a map of the proposed
ocation, giving, for the space of one mile above and one mile below such proposed
ocation, the topography of the banks of the river, with shore-lines and soundings,
nd such other information as may be required for a full understanding of the sub-
ject; and until the said plan and location of the bridge are approved by the Secretary
of War the construction of said bridge shall not be commenced: *Provided,* That if the
said bridge shall be made with unbroken and continuous spans, it shall have three or
more channel-spans, and shall not be of less elevation in any case than fifty feet
above extreme high-water mark, as understood at the point of location, to the lower
part of the superstructure of the bridge, nor shall the spans of said bridge be less than
three hundred feet in length, and the main span shall be over the main channel of
the river, and the piers of the said bridge shall be parallel with the current of said
river, and the bridge itself at right angels thereto: *And provided, also,* That if any
bridge built under this act be constructed as a draw-bridge, it shall have a draw over
the main channel of the river at an accessible and navigable point, and with a span
or spans not less than three hundred feet in length in the clear, and no river spans shall
be less than three hundred feet in length in the clear, and the head-room under such
spans shall not be less than ten feet above extreme high-water mark; and the piers of
said bridge shall be parallel with the current of said river, and the bridge itself at
right angles thereto, that said draw shall be opened promptly upon reasonable signal
for the passing of boats, barges and rafts, and said corporation shall maintain, at its
own expense, from sunset to sunrise, such lights or other signals on said bridge as
the Light-House Board shall prescribe: *Provided also,* That all railroad companies
desiring to use said bridge shall have and be entitled to equal rights and privileges
in the passage of the same, and in the use of the machinery and fixtures thereof, and of
all approaches thereto, under and upon such terms and conditions as shall be pre-
scribed by the Secretary of War, in case the parties shall be unable to agree upon
the same.

Sec. 3. That the Secretary of War is hereby authorized and directed, upon receiving such plan and other information, and upon being satisfied that a bridge so built will conform to the requirements of this act, to notify the company that he approves of the same; and upon receiving such notification the said company may proceed to erect said bridge, conforming strictly to the approved plan and location; and should any change be made in the plan of the bridge or accessory works during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War.

SEC. 4. That said bridge and accessory works, when built and constructed under this act according to the terms and limitations thereof, shall be lawful structures; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States; and Congress reserves the right at any time to regulate by appropriate legislation the charge for freight and passengers over said bridge.

SEC. 5. That the United States shall have the right of way for such postal-telegraph lines across said bridge as the Government may construct or control; and equal privileges in the use of said bridge shall be granted to all telegraph companies.

SEC. 6. That Congress shall have power at any time to alter, amend, or repeal this act, so as to remove all material and substantial obstructions to the navigation of said river by the construction of said bridge and its accessory works, or to prevent such obstruction; and the expense of altering said bridge or removing such obstructions shall be at the expense of the owners of such bridge.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, August 6, 1888.

AN ACT authorizing the construction of a bridge over the Tennessee River at or near Lamb's Ferry, Alabama, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Cincinnati, Nashville and New Orleans Railroad Company of Alabama, a corporation duly and legally incorporated under the laws of the State of Alabama, its successors or assigns, to construct and maintain a bridge over the Tennessee River at or near Milton's Bluff or Lamb's Ferry, Alabama. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the persons by whom it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be approved from time to time by the Secretary of War.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over said bridge, than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridge; and it shall enjoy the rights and privileges of other post-roads in the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes.

SEC. 3. That the said bridge shall be constructed as a draw-bridge, the draw or pivot pier shall be at such point in the channel of the river as the Secretary of War may direct, and the opening or passage-way of said draw-pier shall be so protected and arranged that water-craft can be worked through it at any and all times; and the draw-span shall not be of less width than the widest draw-spans authorized by Congress for any bridge on the Tennessee River, and the lowest point of said draw-span shall be as high above the water as the highest draw-span connected with any bridge over the Tennessee River, and the piers of said bridge shall be parallel with and the bridge itself at right angles to the current of the river: *Provided, also,* That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light House Board shall prescribe. No bridge shall be erected or maintained under the authority of this act which shall at any time substantially or materially obstruct the free navigation of said river; and if any bridge erected under such authority shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge to be made as will effectually obviate such obstruction; and all such alterations shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river caused or alleged to be caused by said bridge, the cause may be brought in the circuit court of the United States of the State of Alabama in whose jurisdiction any portion of said obstruction or bridge may be located, *Provided, further,* That nothing

n this act shall be so construed as to repeal or modify any of the provisions of law
iow existing in reference to the protection of the navigation of rivers, or to exempt
his bridge from the operation of the same.

SEC. 4. That all railroad companies desiring the use of said bridge shall have and
e entitled to equal rights and privileges relative to the passage of railway trains
ver the same, and over the approaches thereto, upon payment of a reasonable com-
ensation for such use; and in case the owner or owners of said bridge and the sev-
ral railroad companies, or any one of them, desiring such use, shall fail to agree
pon the sum or sums to be paid, and upon rules and conditions to which each shall
onform in using said bridge, all matters at issue between them shall be decided by
he Secretary of War, upon a hearing of the allegations and proofs of the parties.

SEC. 5. That any bridge authorized to be constructed under this act shall be built
nd located under and subject to such regulations for the security of navigation of
aid river as the Secretary of War shall prescribe; and to secure that object the said
ompany or corporation shall submit to the Secretary of War, for his examination
nd approval, a design and drawings of the bridge, and a map of the location, giving,
or the space of one mile above and one mile below the proposed location, the topog-
aphy of the banks of the river, the shore-lines at high and low water, the direction
nd strength of the currents at all stages, and the soundings, accurately showing the
ed of the stream, the location of any other bridge or bridges, and shall furnish such
ther information as may be required for a full and satisfactory understanding of the
ubject; and until the said plan and location of the bridge are approved by the Sec-
etary of War the construction of said bridge shall not be commenced; and should
ny change be made in the plan of said bridge during the progress of construction,
uch change shall be subject to the approval of the Secretary of War.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge
erein authorized be not commenced within one year and completed within three
ears from the date thereof.

Approved, August 6, 1888.

N ACT to authorize the construction of a railroad, wagon, and foot-passenger bridge across the
Hillsborough River, at a point in the town of New Smyrna, in the county of Volusia and State of
Florida.

*Be it enacted by the Senate and House of Representatives of the United States of Amer-
ca in Congress assembled,* That the Atlantic and Western Railroad Company, a corpo-
ation organized under the laws of the State of Florida, its successors and assigns,
e, and are hereby, authorized to construct and maintain a bridge, and approaches
hereto, over the Hillsborough River, in the county of Volusia, State of Florida, at
he most accessible point on said river, in the town of New Smyrna, in said county
nd State. Said bridge shall be constructed to provide for the passage of railway
rains, and, at the option of the corporation by which it may be built, may be used
or the passage of wagons and vehicles of all kinds for the transit of animals and for
oot-passengers, for such reasonable rates of toll as may be approved, from time to
ime, by the Secretary of War.

SEC. 2. That any bridge built under this act shall be constructed without interfer-
nce with the security and convenience of navigation of said river; and in order to
ecure a compliance with these conditions the corporation, previous to commencing
he construction of the bridge, shall submit to the Secretary of War a plan of the
ridge and of any accessory works, together with a detailed map of the river at the
roposed site of the bridge and for a distance of a mile above and below the site, to-
ether with all other information touching said bridge and river and accessory works
s may be deemed requisite by the Secretary of War to determine whether the said
ridge when built, will conform to the prescribed conditions of this act: *Provided*,
hat the piers of said bridge shall be parallel with the current of said river, with
lear openings between them, the axis of the bridge as nearly as possible at right
ngles thereto, and the lowest part of the superstructure at least six feet above the
evel of the water at its highest stage: *And provided, also*, That any bridge built un-
ler this act shall be constructed as a pivot draw-bridge, with a draw over the main
hannel of the river at the most accessible and navigable point, and with spans of
ot less than one hundred feet in length in the clear on each side of the central or
ivot-pier of the draw, and with the piers adjacent to the draw openings provided
vith suitable guide cribs or piers: *Provided also*, That said draw shall be opened
romptly upon reasonable signal for the passing of boats; and said company or cor-
oration shall maintain, at its own expense, from sunset to sunrise, such lights or other
ignals on said bridge as the Light-House Board shall prescribe.

SEC. 3. That the Secretary of War is hereby authorized and directed, upon receiv-
ng any such plan and map and other information, and upon being satisfied that a

bridge built on such plan and with such accessory works and at such locality will conform to the prescribed conditions of this act, to notify the company that he approves of the same; and upon receiving such notification the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location, but until the Secretary of War approves of the plan and location of said bridge and accessory works, and notifies the company of the same, the bridge shall not be built: and should any change be made in the plan of the bridge or said accessory works during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War.

SEC. 4. That any bridge and accessory works, when built and constructed under this act and according to the terms and limitations thereof, shall be a lawful structure: and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States; and equal privileges in the use of said bridge, shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal-telegraph purposes; and Congress reserves the right at any time to regulate by appropriate legislation the charges for freight and passengers over said bridge.

SEC. 5. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any one of them desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon the hearing of the allegations and proofs of the parties.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require any changes in said structure, or entire removal, at the expense of the owners thereof, whenever Congress shall decide that the public interests require it, is also expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, August 6, 1888.

AN ACT to authorize the construction and maintenance of a pile bridge over the Halifax River at Daytona, Volusia County, Florida.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That to the Halifax River Bridge and Street Railway Company, a body corporate existing by and under the laws of the State of Florida, its successors or assigns, is granted the consent of the Government to construct and maintain a pile bridge provided with a suitable draw, over the Halifax River at Daytona, Volusia County, Florida, to be used for the passage of foot-passengers, animals, and vehicles of all kinds, for reasonable rates of toll, to be approved from time to time by the Secretary of War, and, at the option of the company, to be used for the passage of railway trains and street-cars.

SEC. 2. That the draw of said bridge shall be in charge of some person, so that at all times the same may, without unnecessary delay, be opened for the passage of steam and sail boats or other water-craft navigating said river, and said company shall maintain, at its own expense, such lights on the bridge as may be required by the Light-House Board for the safety of navigation.

SEC. 3. That the bridge constructed under this act shall be a lawful structure, and shall be recognized and known as a post-route, upon which, also, no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than other persons pay for like transportation; and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of a way for postal telegraph across said bridge, and all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon hearing of the allegations and proofs of the parties: *Provided*, That before this act shall take effect the plans therefor and the location of said bridge shall be submitted to and approved by the Secretary of War, and the company shall further submit to him a detailed map of the river at the proposed site, and for one mile above and one mile below the same, giving the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject: *And provided further*, That the right to alter or amend this act, so as to prevent or remove all material obstructions to the navigation of said river, is hereby expressly reserved, and all changes or alterations so required shall be made at the expense of the parties owning or controlling said bridge.

SEC. 4. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year, and completed within three years, from the date thereof.

Approved, August 6, 1888.

AN ACT to authorize the construction of a railroad, wagon, and foot-passenger bridge across the Saint John's River, between De Land Landing and Lake Monroe, in the State of Florida.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Atlantic and Western Railroad Company, a corporation organized under the laws of the State of Florida, its successors and assigns, be, and are hereby, authorized to construct and maintain a bridge and approaches thereto, over the Saint John's River, in the State of Florida, at any accessible point between De Land Landing and Lake Monroe, on said river. Said bridge shall be constructed to provide for the passage of railway trains, and, at the option of the corporation by which it may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals and for foot passengers, for such reasonable rates of toll as may be approved, from time to time by the Secretary of War.

SEC. 2. That any bridge built under this act shall be constructed without interference with the security and convenience of navigation of said river; and in order to secure a compliance with these conditions the corporation, previous to commencing the construction of the bridge, shall submit to the Secretary of War a plan of the bridge, and of any accessory works, together with a detailed map of the river at the proposed site of the bridge and for a distance of a mile above and below the site, together with all other information touching said bridge and the river and accessory works as may be deemed requisite by the Secretary of War to determine whether the said bridge when built will conform to the prescribed conditions of this act: *Provided*, That the piers of said bridge shall be parallel with the current of the river, with clear openings between them and the axis of the bridge as nearly as possible at right angles to the current, and that the lowest part of the superstructure of the bridge shall be at least four feet above the surface of the river at its highest flood stage, and with the piers adjacent to the draw-span provided with suitable guide piers or cribs: *And provided also*, That any bridge built under this act shall be constructed as a pivot draw-bridge, with a draw over the main channel of the river at an accessible and navigable point, and with spans of not less than one hundred feet in length in the clear on each side of the central or pivot pier of the draw: *Provided also*, That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light House Board shall prescribe.

SEC. 3. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any one of them, desiring such use shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War, upon hearing of the allegations and proofs of the parties.

SEC. 4. That the Secretary of War is hereby authorized and directed, upon receiving any such plan and map and other information and upon being satisfied that a bridge built on such plan with such accessory works and at such locality will conform to the prescribed conditions of this act, to notify the company that he approves the same, and, upon receiving such notification, the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location; but until the Secretary of War approves the plan and location of said bridge and accessory works and shall notify the company of the same, the bridge shall not be commenced or built; and should any change be made in the plan of the bridge or said accessory works during the progress of the work thereon, such change shall be subject likewise to the approval of the Secretary of War.

SEC. 5. That any bridge and accessory works, when built and constructed under this act and according to the terms and limitations thereof, shall be a lawful structure; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States; and equal privileges in the use of such bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes; and Congress reserves the right at any time to regulate by appropriate legislation the charges for freight and passengers over said bridge.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved; and the right to require any changes in said structure, or its removal, at the expense of the owners thereof, whenever Secretary of War shall decide that the public interests require it, is also expressly reserved.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, August 6, 1888.

AN ACT to authorize the construction of a bridge across the Oostanaula River, at or near Rome, Georgia.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Chattanooga, Rome and Columbus Railroad Company, a corporation organized under the laws of the State of Georgia, be, and the same is hereby, authorized to construct and maintain a bridge across the Oostanaula River, and approaches to said bridge, at or near Rome, in the county of Floyd, and State of Georgia, for the passage of railway trains.

SEC. 2. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, and it shall enjoy the rights and privileges of other post-roads in the United States, upon which no higher charge shall be made for the transmission over the same of the mail, troops and munitions of war of the United States, or for through railway passengers or freight passing over said bridge, than the rate per mile for their transmission over the railroad leading to said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge for postal-telegraph purposes; that the said bridge shall be constructed, either by draw, span, or otherwise, that a free and unobstructed passage-way may be secured to all water-craft navigating said river at the point aforesaid: *Provided,* That if said bridge authorized to be constructed under this act shall be constructed as a draw-bridge, the draw shall be opened promptly upon the reasonable signals for the passage of boats or vessels; and said corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light House Board shall prescribe.

SEC. 3. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of a reasonable compensation for such use; and in case the owner or owners of said bridge, and the several railroad companies, or any one of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon the hearing of the allegations and proofs of the parties.

SEC. 4. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving, for the space of one mile below and one mile above the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the construction of said bridge shall not be commenced; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the Secretary of War.

SEC. 5. That the right to alter, amend, or repeal this act, is hereby expressly reserved; and any alterations or changes that may be required by the Secretary of War in the bridge constructed under this act, or its entire removal shall be made by the corporation owning or controlling the same, at its own expense. Furthermore, if the construction of said bridge shall not be commenced within two and completed within four years after the passage of this act, all privileges conferred hereby, and this act, shall become null and void.

Approved, August 6, 1888.

AN ACT authorizing the Houston, Central Arkansas and Northern Railway Company to construct and maintain bridges across Bayou Bartholomew and across Ouachita, Red, Little, and Sabine Rivers in Louisiana.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Houston, Central Arkansas and Northern Railroad Company, a corporation created and existing under and by virtue of the laws of the States of Louisiana and Arkansas, be, and is hereby, authorized to construct and maintain bridges across Bayou Bartholomew, Ouachita River, Little River, Red River, and Sabine River, in the State of Louisiana, at such points as may hereafter be selected by said railway company for crossing said rivers with its railroad line. Said bridges shall be constructed to provide for the passage of railway trains, and at the option of the said railway company by whom they may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates of toll as may be fixed by said railway company, and approved by the Secretary of War.

SEC. 2. That said bridges built under this act and subject to its limitations shall be lawful structures, and shall be recognized and known as post-routes, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to the said bridges, and they shall enjoy the rights and privileges of other post-roads in the United States; and equal privileges in the use of said bridges shall be granted to all telegraph companies; and the United States shall have the right of way across said bridges, and its approaches, for postal-telegraph purposes.

SEC. 3. That if said bridge or bridges erected and maintained under the authority of this act shall at any time substantially or materially obstruct the free navigation of said bayou or river, or shall, in the opinion of the Secretary of War, obstruct such navigation, he is hereby authorized to cause such change or alteration of said bridge or bridges to be made as will effectually obviate such obstruction; and such alteration shall be made and all such obstructions be removed at the expense of the owner or owners of said bridge; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said bayou or rivers, or either of them, the case may be brought in the district court of the United States of the State of Louisiana in which any portion of said obstruction or bridge may be located: *Provided,* That nothing in this act shall be so construed as to repeal or modify any of the provisions of law now existing in reference to the protection of the navigation of rivers, or to exempt said bridge or bridges from the operation of the same.

SEC. 4. That all railroad companies desiring the use of said bridge or bridges shall have and be entitled to equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use.

SEC. 5. That the bridge or bridges authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said bayou and rivers as the Secretary of War shall prescribe, and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of said bridge or bridges, and a map of the location, giving for the space of one mile above and one mile below the proposed location of the bridge or bridges, the topography of the banks of the bayou or rivers, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plans and location of the bridges are approved by the Secretary of War, the bridge or bridges shall not be built, and should any change be made in the plan of the said bridge or bridges during the progress of construction, such change shall be subject to the approval of the Secretary of War, and said structure or structures sh be changed, at the cost and expense of the owners thereof, from time to time as t Secretary of War may direct, so as to preserve the free and convenient navigation o said bayou or rivers.

SEC. 6. That this act shall be null and void if actual construction of the bridg herein authorized be not commenced within one year and completed within four ye from the date thereof.

SEC. 7. That the right to alter, amend, or repeal this act is hereby expressly r served.

Approved, August 6, 1888.

AN ACT to authorize the Macon, Tuscaloosa and Birmingham Railroad Company to build bri across the Black Warrior River and the Tombigbee River in Alabama.

Be it enacted by the Senate and House of Representatives of the United States of Am in Congress assembled, That the Macon, Tuscaloosa and Birmingham Railroad C pany, a corporation created and existing under the laws of Alabama, be, and hereby, authorized to erect and maintain bridges across the Black Warrior River, or near Foster's Ferry, or at such point near said ferry as shall be selected by s railroad company for crossing said river with their railroad line, and across the To bigbee River in or near township twelve, at such point as shall be selected by s railroad company for crossing said river with their railroad line, the said bridges have each a draw-span, so as not to interfere with the navigation of said river: *P vided,* That any bridge constructed under this act and according to its limitati shall be a lawful structure, and shall be known and recognized as a post-route, a the same is hereby declared to be a post-route, upon which also no higher charge sh be made for the transmission over the same of the mails, the troops, and muniti of war of the United States, or for through passengers or freight passing over s bridge, than the rate per mile paid for their transportation over the railroads lea to the said bridges, and equal privileges in the use of said bridges shall be gran to all telegraph and telephone companies; and the United States shall have t right of way across said bridges and their approaches for postal-telegraph purpo

SEC. 2. That the plan and location of said bridges, with a detailed map of t rivers at the proposed sites of the bridges and near thereto, exhibiting the depths a and currents, shall be submitted to the Secretary of War for his approval, and un he approves the plans and locations of said bridges they shall not be built; but up the approval of said plans by the Secretary of War the said company or corporati may proceed to the erection of said bridges in conformity with said approved pl and should any change be made in the plans of said bridges during the progress the work thereon, such change shall be subject likewise to the approval of the S retary of War. And there shall be displayed on said bridges from sunset to sunri such lights or other signals as may be prescribed by the Light-House Board.

SEC. 3. That Congress reserves the right to alter, amend, or repeal this act at a time; and that if at any time navigation of said rivers shall in any manner be o structed or impaired by the said bridges, the Secretary of War shall have authori and it shall be his duty, to require the said railroad company to alter and cha the said bridges, at its own expense, in such manner as may be proper to secure f and complete navigation without impediment; and if upon reasonable notice to s railroad company to make such changes or improvements the said company fail do so, the Secretary of War shall have authority to make the same at the expe of said company, and all the rights conferred by this act shall be forfeited; and Co gress shall have power to do any and all things necessary to secure the free navig tion of the said rivers.

SEC. 4. That this act shall be null and void if actual construction of the bridg herein authorized be not commenced within two years, and completed within fi years, from the date thereof.

Approved, August 6, 1888.

AN ACT to authorize the construction of a bridge across the Chattahoochee River in the Stat Georgia.

Be it enacted by the Senate and House of Representatives of the United States of Ame in Congress assembled, That the assent of Congress is hereby given to the Americ Preston and Lumpkin Railroad Company, an organization incorporated under t laws of the State of Georgia, its successors and assigns, to construct and maintai bridge over the Chattahoochee River in the State of Georgia.

SEC. 2. That said bridge shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object said company or corporation shall submit to the Secretary of War a design and drawings of said bridge, for his examination and approval, and a map of its location, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and in all things shall be subject to such rules and regulations, as may be prescribed by the Secretary of War; and until said plan and location of said bridge are approved by the Secretary of War said bridge shall not be commenced or built; and should any change be made in the plan of said bridge, during the progress of the work of construction, such change shall be subject to the approval of the Secretary of War.

SEC. 3. That any bridge built under this act and subject to its limitations shall be a lawful structure, and shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or passengers or freight passing over said bridge, than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and they shall enjoy the rights and privileges of other post-roads of the United States, and equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes: *Provided also*, That other railroad companies shall have the right to run their cars over said bridge, upon such just and reasonable terms as may be agreed upon by them and the corporation owning or controlling said bridge, and if the parties cannot agree, then the terms shall be determined by the Secretary of War.

SEC. 4. That the right, to alter, amend, or repeal this act is hereby expressly reserved; and the right to require any changes in said structure, or its removal, at the expense of the owners thereof, whenever the Secretary of War shall decide that the public interest requires it, is also expressly reserved.

SEC. 5. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, August 6, 1888.

AN ACT to authorize the construction of a bridge across the Alabama River.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Alabama Great Northwestern Railway Company, a corporation existing under the laws of the State of Alabama, and having authority to build its line of railroad from a point in the State of Alabama, at or near Montgomery through the State of Alabama to a point at or near the town of Tuscaloosa, in said State, be, and is hereby, authorized to construct and maintain, for the purpose of making a more perfect connection of its said line, the following railroad bridge, to be used by it, its successors or assigns, for railway purposes, over the rivers and at the localities named following, that is to say, across the Alabama River near the city of Montgomery, in the State of Alabama, at the most suitable and convenient point within ten miles of said city of Montgomery.

SEC. 2. That any bridge built under this act shall be constructed and built without interference with the security and convenience of navigation of said river, beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure a compliance with these conditions, the corporation, previous to commencing the construction of the said bridge, or of the accessory works, in the booms, dikes, or piers designed to secure the best practical channel-way for navigation and confine the flow of the water to a permanent channel, and for the guiding of steamboats and rafts safely through the drawn spans at said point, shall submit to the Secretary of War a plan of the bridge and of such accessory works, together with a detailed map of the river at the proposed site of the bridge, and for a distance of a mile above and below the site, together with all other information touching said bridge and river and accessory works as may be deemed requisite by the Secretary of War to determine whether the said bridge, when built, will conform to the prescribed conditions of this act; that as nearly as practicable, the said bridge shall be at right angles to, and the piers parallel with, the current of said river; and should it be found hereafter that the said bridge or accessory works interfere with the security and convenience of navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted, by reason of any defect or failure in the accessory works aforesaid to accomplish the purpose for which they are designed, it shall be the duty of the Secretary of War to require the necessary changes to be made therein in the interest of navigation, at the expense of the owners: *Provided*, That as to any bridge built under this act, if the said bridge shall be made with unbroken and continuous spans, it shall be of such elevation above extreme high water mark as understood at the point of location, to the lowest part of the superstructure of the bridge, and the spans of said bridge shall be of such width as may be prescribed by the Secretary of War: *And provided also*, That if any bridge built under this act shall be constructed as a draw-bridge, the same shall be constructed as a pivot draw-bridge with a draw over the main channel of the river at an accessible and navigable point, and with spans of such width and elevation above extreme high water at the point of location as may be required by the Secretary of War: *Provided, also*, That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe: *Provided, also*, That any railroad companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War upon hearing the allegations and proofs of the parties in case they shall not agree.

SEC. 3. That the Secretary of War is hereby authorized and directed, upon receiving any such plans and map and other information, and upon being satisfied that a bridge built on such plan and with such accessary works, and at such locality will conform to the prescribed conditions of this act, to notify the company that he approves the same; and upon receiving such notification the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location, but until such notification has been received, the bridge shall not be commenced or built: should any material change be made in the plan of the bridge or said accessory works during the progress of the work thereon, such change shall be likewise subject to the approval of the Secretary of War. The Secretary may at any time, when in his judgment necessary, require the company owning or controlling said bridge to change the same in any respect, or to entirely remove the structure, all such changes or the entire removal to be at the expense of said company, and if refusal shall be made to comply with his requirements the Secretary of War shall cause such changes to be made, or the entire removal of said bridge, and to cause proceedings to be instituted in the name of the United States in the District court of the United States in whose territorial jurisdiction said bridge or any part thereof is located, for the purpose of recovering from the parties owning said bridge the amount expended in such changes or removal, together with all costs of such litigation.

SEC. 4. That any bridge and accessory works when built and constructed under this act and according to the terms and limitations thereof, shall be a lawful structure, and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States: and Congress reserves the right at any time to regulate by appropriate legislation the charges for freight and passengers over said bridge.

SEC. 5. The United States shall have the right way for postal-telegraph across said bridge, and equal privileges in the use of said bridge shall be granted to all telegraph companies.

SEC. 6. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 7. That the right to alter, amend, or repeal this act is expressly reserved.

Approved, August 6, 1888.

AN ACT to authorize the construction of bridges across the Flint and Chattahoochee Rivers.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Alabama Midland Railway Company, a corporation existing under the laws of Georgia and Alabama, and having authority to build its line of railroad from a point in the State of Georgia, at or near Bainbridge, to and into the State of Alabama, to a point at or near Montgomery, the capital of said State of Alabama, be, and is hereby, authorized to construct and maintain, for the purpose of making a more perfect connection of its said line, the following railroad bridges, to be used by it, its successors or assigns, for railway purposes, over the rivers and at the localities named following, that is to say: across the Flint River near the city of Bainbridge, in the States of Georgia, at the most suitable and convenient point within one mile of said city of Bainbridge, and across the Chattahoochee River, at or near the town of Gordon, in the State of Alabama, at the most suitable and convenient place and within five miles of said town of Gordon.

Sec. 2. That any bridge built under this act shall be constructed and built without interference with the security and convenience of navigation of said rivers, or either of them, beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure a compliance with these conditions, the corporation, previous to commencing the construction of the bridges, or of the accessory works in the booms, dikes, or piers designed to secure the best practical channelway for navigation and confine the flow of the water to a permanent channel, and for the guiding of steam-boats and rafts safely through the draw-spans at said point, shall submit to the Secretary of war a plan of the bridge and of such accessory works, together with a detailed map of the river at the proposed site of the bridge and for a distance of a mile above and below the site, together with all other information touching said bridge and river and accessory works as may be deemed requisite by the Secretary of War to determine whether the said bridge, when built, will conform to the prescribed conditions of this act; that as nearly as practicable the said bridge shall be at right angles to, and the piers parallel with, the current of said river; and should it be found hereafter that the said bridge or accessory works interfere with the security and convenience of navigation of said river beyond what is necessary to carry into effect the rights and privileges hereby granted, by reason of any defect or failure in the accessory works aforesaid to accomplish the purpose for which they are designed, it shall be the duty of the Secretary of War to require the necessary changes to be made therein in the interest of navigation, or its entire removal, at the expense of the owners; and if any litigation shall be necessary to collect from such owners the expense of making the necessary changes in said bridge, or of its entire removal, the same shall be had in the district court of the United States in whose territorial jurisdiction said bridge or any part thereof is located: *Provided*, That as to any bridge built under this act, if it be made with unbroken and continuous spans it shall be of such elevation above extreme high water, as understood at the point of location, to the lowest part of the superstructure of the bridge, as the Secretary of War may prescribe, and the spans of said bridge shall also be of such width as may be required by the Secretary of War in the interests of navigation: *And provided also*, That if any bridge built under this act shall be constructed as a draw-bridge, the same shall be constructed as a pivot draw-bridge, with a draw over the main channel of the river, at an accessible and navigable point, and with spans of such height above extreme high-water mark at the point of location, and such width, as may be prescribed by the Secretary of War in considering the requirements of navigation: *Provided, also*, That said draw shall be opened promptly upon reasonable signal for the passing of boats; and said company or corporation shall maintain, at its own expense, from sunset till sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe: *Provided, also*, That any railroad companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same and in the use of the machinery and fixtures thereof and of all the approaches thereto under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties in case they shall not agree.

Sec. 3. That the Secretary of War is hereby authorized and directed, upon receiving any such plans and map and other information, and upon being satisfied that a bridge built on such plan and with such accessory works, and at such locality will conform to the prescribed conditions of this act, to notify the company that he approves the same; and upon receiving such notification the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location; but until such notification has been received the bridges shall not be commenced or built, and should any material changes be made in the plan of the bridge or said accessory works, during the progress of the work thereon, such change shall be likewise subject to the approval of the Secretary of War.

Sec. 4. That any bridge and accessory works when built and constructed under this act and according to the terms and limitations thereof, shall be a lawful structure; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroads or public highway leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way for postal telegraph purposes across said bridge and its approaches; and Congress reserves the right at any time to regulate by appropriate legislation the charges for freight and passengers over said bridges.

Sec. 5. That this act shall be null and void if actual construction of the bridges herein authorized be not commenced within one year and completed within three years from the date thereof.

Sec. 6. That the right to alter, amend, or repeal this act is expressly reserved.

Approved, August 6, 1888.

AN ACT to authorize the construction of a bridge across the Missouri River and to establish it as a post-road.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That it shall be lawful for the Chicago, Oquawka and Kansas City Short Line Railway Company, a corporation organized under the laws of the State of Illinois, or its successors or assigns, to construct a bridge across the Missouri River at a point opposite or nearly opposite the town of Parkville, in the State of Missouri; that said bridge may be constructed for railway and postal service, with single or double tracks for railway traffic, and which shall be under the conditions and limitations hereinafter specified.

SEC. 2. That said bridge shall not interfere with the free navigation of said river beyond what may be necessary to carry into effect the rights and privileges herein granted; and in case of any litigation arising under the provisions of this act such litigation may be tried and determined by the circuit of the United States within whose jurisdiction said bridge or any part thereof is located.

SEC. 3. That the bridge hereby authorized to be constructed must be constructed as a high bridge with unbroken and continuous spans having at least one channel-span of not less than four hundred feet clear channel-way and all other spans over the water-way to have a clear channel-way of not less than three hundred feet: and all spans shall have a clear head-room of not less than fifty feet above high-water mark.

SEC. 4. That any bridge constructed under this act shall be a lawful structure, and shall be known as a post-road, and the same is hereby declared to be a post-road, over which no higher charge shall be made for the transportation of mails, troops, and munitions of war of the Government of the United States or for passenger or freight passing over the same than the rate per mile charged for their transportation over the railroad or public highways leading to the said bridge, and equal privileges in the use of said bridge shall be granted to all telegraph companies. The United States shall also have the right of way over said bridge for postal telegraph purposes.

SEC. 5. That all railway companies desiring to use said bridge shall be entitled to equal rights and privileges in using the same, including the machinery and fixtures thereto belonging, and also the approaches thereto, upon such terms and conditions as shall be prescribed by the Secretary of War upon hearing the allegations and proofs of the parties in interest, in case the parties in interest shall not be able to agree upon such terms and conditions.

SEC. 6. That the said railway company, before entering upon the construction of said bridge, shall submit to the Secretary of War plans and drawings of such structure, together with a map of the location thereof for one mile above and one mile below said location, giving the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the current of said river at all stages of water, showing also the bed of the river and the channel, with such other and further information as the Secretary of War may require, which said drawings and other information aforesaid shall be examined by him, and if he shall approve the same he shall so notify the said railway company of such approval, and therefrom said company may proceed to the erection of said bridge. The Secretary of War may make such alterations in such plans as he may deem necessary to the better protection of navigation, and such alterations shall be adopted by said railway company. The said railway company may at any time make any alterations deemed advisable to be made in said bridge, but must first submit such proposed alterations to the Secretary of War, and his approval shall be first had before they shall be authorized or made.

SEC. 7. That the said bridge herein authorized to be constructed shall be so kept and managed at all times as to afford proper means and ways for the passage of vessels, barges, or rafts under it both by day and night. There shall be displayed on said bridge from sunset to sunrise such lights and signals as may be directed by the Light-House Board. And such changes may be made from time to time in the structure of said bridge as the Secretary of War may direct, at the expense of said railway, in order the more effectually to preserve the free navigation of said river, or the said structure shall be altogether removed if in the judgment of the Secretary of War the public good may require such removal, and without expense or charge to the United States.

SEC. 8. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

SEC. 9. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, August 7, 1888.

ACT to authorize the construction of a bridge across the Tennessee River at or near Knoxville, Tennessee.

Be it enacted by the Senate and House of Representatives of the United States of America
Congress assembled, That the Knoxville Southern Railroad Company, a corporation
ganized under the laws of the State of Tennessee, be, and is hereby, authorized to
nstruct and maintain a bridge, and approaches thereto, over the Tennessee River,
or within two miles of the city of Knoxville, Tennessee. Said bridge shall be con-
ucted to provide for the passage of railway trains, and, at the option of the cor-
ration by which it may be built, may be used for the passage of wagons and vehi-
s of all kinds, for the transit of animals, and for foot passengers, for reasonable
tes of toll, to be fixed by said company; and the Secretary of War shall have the
ht, from time to time, to revise, prescribe, and determine such rates or tolls.

SEC. 2 That any bridge built under this act and subject to its limitations shall be a
ful structure, and shall be recognized and known as a post-route, and it shall en-
y the rights and privileges of other post-roads in the United States, and the same
hereby declared to be a post-route, upon which also no higher charge shall be made
r the transmission over the same of the mail, troops, and munitions of war of the
ited States than the rate per mile for their transmission over the railroad leading
said bridge, and equal privileges in the use of said bridge shall be granted to all
legraph companies, and the United States shall have the right of way across said
idge for postal telegraph purposes; that the said bridge shall be so constructed,
ther by draw-span or otherwise, that a free and unobstructed passage-way may be
cured to all water-craft navigating said river at the point aforesaid: *Provided*, That
said bridge, authorized to be constructed under this act, shall be constructed as a
aw-bridge, the draws shall be opened promptly upon the reasonable signals for the
ssage of boats or vessels; and said corporation shall maintain at its own expense,
om sunset to sunrise, such lights or other signals on said bridge as the Light-House
ard shall prescribe.

SEC. 3. That all railroad companies desiring the use of said bridge shall have and
entitled to equal rights and privileges relative to the passage of railway trains
er the same, and over the approaches thereto, upon the payment of a reasonable
mpensation for such use; and in case the owner or owners of said bridge and the
veral railroad companies, or any of them, desiring such use, shall fail to agree upon
e sum or sums to be paid, and upon rules and conditions to which each shall con-
rm in using said bridge, all matters at issue between them shall be decided by the
cretary of War upon the hearing of the allegations and proofs of the parties.

SEC. 4. That any bridge authorized to be constructed under this act shall be built
d located under and subject to such regulations for the security of navigation of
id river as the Secretary of War shall prescribe; and to secure that object the said
mpany or corporation shall submit to the Secretary of War, for his examination
d approval, a design and drawings of the bridge, and a map of the location, giving,
r the space of one mile below and one mile above the proposed location, the topog-
phy of the banks of the river, the shore-lines at high and low water, the direction
d strength of the current at all stages, and the soundings, accurately showing the
d of the stream, the location of any other bridge or bridges, and shall furnish such
her information as may be required for a full and satisfactory understanding of the
bject; and until the said plan and location of the bridge are approved by the Sec-
tary of War the construction of said bridge shall not be commenced; and should
y change be made in the plan of said bridge during the progress of construction,
ch change shall be submitted to and subject to the approval of the Secretary of
ar.

SEC. 5. That the right to alter, amend, or repeal this act, is hereby expressly re-
rved; and any alterations or changes that may be required by the Secretary of War
the bridge constructed under this act, or its entire removal shall be made by the
rporation owning or controlling the same, at its own expense. Futhermore, if the
nstruction of said bridge shall not be commenced within two and completed within
ur years after the passage of this act, all privileges conferred hereby, and this act,
all become null and void.

Approved, August 9, 1888.

N ACT to authorize the construction and maintenance of a railroad bridge by the Birmingham, Atantic and Air Line Railroad and Banking and Navigation Company across the Oconee River in Laurens County, State of Georgia.

Be it enacted by the Senate and House of Representatives of the United States of America
Congress assembled, That the Birmingham, Atlantic and Air Line Railroad and
anking and Navigation Company, a corporation under the laws of Georgia, be, and
e said corporation is hereby, authorized and permitted to construct and maintain
railroad bridge across the Oconee River at or near the city of Dublin, in the county
Laurens, in the State of Georgia.

SEC. 2. That said bridge shall be constructed and built without material interference with the security and convenience of the navigation of said river, beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a plan, design, and drawings of the bridge and a map of location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore-lines at high and low water, the direction and strength of the currents at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject, and until the said plan and location of the bridge are approved by the Secretary of War the construction of said bridge shall not be commenced: *Provided*, That said bridge shall be built with draw-spans giving eighty feet clear width at low water on either side of the pivot pier in main channel and that the draw shall be opened promptly upon reasonable signal for the passage of boats, barges, and rafts, and in no case shall unnecessary delay occur; and said company or corporation shall maintain, at its own expense, from sunset till sunrise such lights or other signals on said bridge as the Light House Board shall prescribe.

SEC. 3. That the Secretary of War is authorized and directed, upon receiving said plan, map, and other information, upon being satisfied that the bridge built upon such plan and with such accessory works and at such locality will conform to the prescribed conditions of this act, to notify said company or corporation that he approves the same; and upon receiving such notification said company or corporation may proceed to the erection of said bridge, conforming strictly to the approved plan and location; and should any change be made in the plan of the bridge or said accessory works during the progress of the work thereon, such change shall be likewise subject to the approval of the Secretary of War; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States within whose jurisdiction said bridge or any part thereof is located.

SEC. 4. That the said bridge and accessory works, when built and constructed under this act and according to the terms and limitations thereof, shall be lawful structures; and said bridge shall be recognized and known as a post-route, upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passengers and freight passing over said bridge, than the rate per mile paid for the transportation over the railroads or public highways leading to said bridge, and said bridge shall enjoy the rights and privileges of other post-routes in the United States.

SEC. 5. That the United States shall have the right of way for such postal-telegraph lines across said bridge as the Government may construct or control, and equal privileges in the use of said bridge shall be granted to all telegraph companies.

SEC. 6. That all railroad companies desiring the use of said bridge shall have and be entitled to equal rights and privileges relative to the passage of railway trains or cars over the same, and over the approaches thereto, upon payment of a reasonable compensation for such use; and in case the owner or owners of said bridge and the several railroad companies, or any of them, desiring such use, shall fail to agree upon the sum or sums to be paid, and upon rules and conditions to which each shall conform in using said bridge, all matters at issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties: *Provided* that the provisions of section four in regard to charges for passengers and freight across said bridge shall not govern the Secretary of War in determining any question arising as to the sum or sums to be paid to the owners of said bridge by said companies for the use of said bridge.

SEC. 7. That the Secretary of War may at any time cause the owners of said bridge to alter the same so as to prevent or remove all material and substantial obstructions to the navigation of said river by the construction of said bridge and its accessory works; and the expense of altering said bridge or removing such obstruction, shall be borne by the owners of or persons controlling such bridge.

SEC. 8. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, August 9, 1888.

AN ACT authorizing the construction of a bridge across the Missouri River, at or near the city of Plattsmouth, Nebraska, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Iowa and Nebraska Bridge Company, a corporation

rganized under the laws of the State of Nebraska, its successors or assigns, is hereby
uthorized to construct, maintain, and operate a bridge across the Missouri River, at
r near the city of Plattsmouth, in the county of Cass and State of Nebraska, and at
uch point as may be hereafter selected by said corporation, its successors or assigns,
nd at least one-third of a mile from any other bridge, as shall best promote the public
onvenience and welfare, and the necessities of business and commerce, and also to
onstruct and maintain the accessory works necessary to secure the best practicable
hannel-way for navigation and to confine the flow of water to a permanent channel
t such point; and said corporation, its successors or assigns, shall construct and main-
ain ways on said bridge for carriages, wagons, and foot-passengers, and may charge
nd receive such reasonable toll therefor as may be approved from time to time by the
ecretary of War: *Provided*, That said bridge may be constructed, maintained, and
sed also for the safe and convenient passage of cable and street cars.

SEC. 2. That the plan and location of said bridge, with a detailed map of the river
t the proposed site of the bridge and near thereto, exhibiting the depths and cur-
ents, shall be submitted to the Secretary of War, for his approval, and until he ap-
rove the plan and location of said bridge the construction shall not be commenced;
ut upon the approval of said plan by the Secretary of War, the said company or corpo-
ation may proceed to the construction of said bridge in conformity with said approved
lan; and should any change be made in the plan of said bridge during the progress
f the work thereon, such change shall be subject likewise to the approval of the Sec-
etary of War.

SEC. 3. That the said bridge and accessory works, when built and constructed under
his act and according to the terms and limitations thereof, shall be lawful structures;
nd said bridge shall be recognized and known as a post-route upon which also no
igher charge shall be made for the transmission over the same of the mails, the
roops, and the munitions of war of the United States, than the rate per mile paid for
he transportation over the railroads or public highways leading to said bridge; and
aid bridge shall enjoy the rights and privileges of other post-routes of the United
tates; and Congress reserves the right at any time to regulate by appropriate legis-
ation the charges for freight and passengers over said bridge. The United States
hall have the right of way for postal telegraph across said bridge, and equal privi-
eges in the use of said bridge shall be granted to all telegraph companies: *Provided*
lso, That the said bridge may be used by all railroad companies for the passage of
heir cars over the same, upon such terms as may be fixed by said company or com-
anies and the corporation owning or controlling said bridge, and if they cannot agree,
hen the charges for the use of said bridge by such other company or companies shall
e established by the Secretary of War, after hearing the parties.

SEC. 4. That Congress reserves the right to alter, amend, or repeal this act at any
ime; and if at any time navigation of the said river shall, in the opinion of the Sec-
etary of War, be in any manner obstructed or impaired by the said bridge, the Sec-
etary of War shall have authority, and it shall be his duty, to require the said cor-
oration, its successors or assigns, to alter and change the said bridge, at its or their
wn expense, in such manner as may be proper to secure free and complete naviga-
ion without impediments; and if upon reasonable notice to said incorporation, to
ake such changes or improvements the said corporation fails to do so, the Secretary
f War shall have authority to make the same at the expense of said corporation, or
o remove said bridge, the amount thereof to be recovered by the United States, by
uit in the United States circuit court within whose jurisdiction the bridge or any
art of it may lie, and all the rights conferred by this act shall be forfeited; and
ongress shall have power to do any and all things necessary to secure the free
avigation of said river.

SEC. 5. That unless the construction of said bridge be commenced within one year
nd completed within three years after the passage of this act, all privileges conferred
ereby shall become null and void.

Approved, August 9, 1888.

AN ACT to provide for the enlargement of the dimensions of the wharf of Fortress Monroe.

*Be it enacted by the Senate and House of Representatives of the United States of America
in Congress assembled*, That the Secretary of War be, and he is hereby, authorized to
cause the plans and specifications under which contract has been entered into by the
United States for the construction of an iron wharf at Fortress Monroe, Virginia, to
be amended and changed so as to require all bearing piles and floor beams of said
wharf to be of iron or steel instead of wood, and to enlarge the dimensions of the said
wharf as designed, and make such other modifications in the plans and specifications
as may be required to meet the necessities of commerce, for which purpose the sum

Improving harbor at Oswego, New York: Continuing improvement and repair, one hundred thousand dollars; of which fifteen thousand dollars shall be used in removing the east breakwater at the mouth of the river.

Improving harbor at Plattsburgh, New York: To complete improvement, seven thousand dollars.

Improving harbor at Rondout, New York: To complete improvement, five thousand dollars.

Improving harbor at Sackett's, New York: Continuing improvement, two thousand dollars.

Improving Tonawanda Harbor and Niagara River, New York, as per report of engineer in charge, dated December twenty-nine, eighteen hundred and eighty-seven, one hundred thousand dollars.

Improving New York Harbor, New York: Continuing improvement, three hundred and eighty thousand dollars.

Improving harbor at Saugerties, New York: Continuing improvement, twelve thousand dollars.

Improving harbor at Wilson, New York: Continuing improvement, five thousand dollars.

Improving harbor at Port Chester, New York: Continuing improvement, five thousand dollars.

Improving harbor at Glen Cove, New York, twenty thousand dollars.

Improving harbor at New Rochelle, New York: Continuing improvement, the balance remaining on hand from former appropriations to be expended in pursuance of the project adopted in eighteen hundred and seventy-one.

Improving channel between Staten Island and the New Jersey shore, New York and New Jersey: Continuing improvement, by dredging fifteen thousand dollars.

Improving Arthur Kill, between Staten Island and the New Jersey shore, New York and New Jersey: Dredging and straightening channel near Staten Island bridge, and removing the point of land westerly of same, ten thousand dollars.

Improving harbor at Raritan Bay, New Jersey: Continuing improvement, twenty-five thousand dollars.

Improving harbor at Erie, Pennsylvania: Continuing improvement, twenty-three thousand dollars.

For the preservation and protection of the peninsula of Presque Isle, Erie Harbor, Pennsylvania, as recommended by the Chief of Engineers, January thirteenth, eighteen hundred and eighty-five, and in accordance with such plans as the Secretary of War may prescribe, sixty thousand dollars.

Improving the harbor of Philadelphia: For the removal of Smith's Island, and Windmill Island, in the State of Pennsylvania, and Petty's Island, in the State of New Jersey, or such parts of them and the shoals adjacent thereto as may be required, and for the improvement of the harbor between the cities of Philadelphia, Pennsylvania, and Camden, New Jersey, five hundred thousand dollars: *Provided*, That no part of this sum shall be expended until the title to the lands forming said islands shall be acquired and vested in the United States without charge to the latter beyond three hundred thousand dollars of the sum herein appropriated.

Improving ice-harbor at Marcus Hook, Pennsylvania: Continuing improvement, fifteen thousand dollars.

Improving Delaware Breakwater, Delaware: Continuing improvement, one hundred thousand dollars.

Improving ice-harbor at New Castle, Delaware: Continuing improvement, seven thousand five hundred dollars.

Improving harbor at Wilmington, Delaware: Continuing improvement, thirty thousand dollars.

Improving harbor at Baltimore, Maryland: Continuing improvement, and widening channel to six hundred feet, three hundred thousand dollars.

Improving harbor at Breton Bay, Maryland: Continuing improvement, three thousand dollars.

Improving harbor at Cambridge, Maryland, five thousand dollars.

Improving harbor at Norfolk and its approaches, Virginia: Continuing improvement, fifty thousand dollars.

Improving approach to Norfolk Harbor, and the United States navy-yard at Norfolk, Virginia: Continuing improvement between Lambert's Point and Fort Norfolk, ten thousand dollars; and the balance of one hundred and nine thousand dollars of former appropriations made under this head and available July first, eighteen hundred and eighty-seven, is hereby authorized to be expended according to the modified plan of the engineer in charge.

Improving harbor at Beaufort, North Carolina: Continuing improvement, thirty-five thousand dollars.

Improving the inland water-way between Beaufort and New River, North Carolina: Continuing improvement, five thousand dollars.

Improving the inland water-way between New Berne and Beaufort, North Carolina: Continuing improvement, fifteen thousand dollars.

Improving harbor at Charleston, including Sullivan's Island, South Carolina: Continuing improvements, three hundred and fifty thousand dollars, of which five thousand dollars may be expended on Mount Pleasant shore of inner harbor of Charleston, South Carolina.

Improving harbor at Georgetown, South Carolina: Continuing improvement, seven thousand five hundred dollars.

Improving Winyaw Bay, South Carolina: Continuing improvement, one hundred thousand dollars. The Secretary of War is authorized and directed to appoint a board of three engineer officers of the United States Army, whose duty it shall be to examine the plan submitted by Captain William H. Bixby, United States Army Engineers, under date of January thirty-first, eighteen hundred and eighty-five, for the improvement of said bay. The said board shall report to the Secretary of War, who shall lay its report before Congress at its next session, with the views of himself and the Chief of Engineers of the United States Army thereon: *Provided*, That nothing herein contained shall be construed to prevent the expenditure of this appropriation.

Improving harbor at Brunswick, Georgia: Continuing improvement, thirty-five thousand dollars.

Improving Cumberland Sound, Georgia and Florida: Continuing improvement, one hundred and twelve thousand five hundred dollars.

Improving harbor at Savannah, Georgia: To complete existing project, one hundred and eighty thousand dollars.

Improving harbor at San Augustine, Florida, thirty-five thousand dollars. The Secretary of War is authorized and directed to appoint a board of three engineer officers of the United States Army, whose duty it shall be to examine into the expediency of further improving the harbor of San Augustine, Florida, upon the plan submitted by Lieutenant William M. Black, United States Army Engineers, under date of December twelfth, eighteen hundred and eighty-seven. The said board shall report to the Secretary of War, who shall lay its report before Congress at its next session, with the views of himself and the Chief of Engineers of the United States Army thereon.

Improving harbor at Apalachicola Bay, Florida: Continuing improvement, twenty housand dollars.

Improving harbor at Cedar Keys, Florida: Continuing improvement, seven thousand five hundred dollars.

Improving harbor at Pensacola, Florida: Continuing improvement, thirty-five thousand dollars.

Improving harbor at Tampa Bay, Florida, from outer bar to Mangrove or Bushy Point, twenty-five thousand dollars.

Improving entrance to harbor at Key West, Florida, twenty-five thousand dollars. The Secretary of War is authorized and directed to appoint a board of three engineer officers of the United States Army, whose duty it shall be to examine into the xpediency of further improving the entrance to the harbor at Key West, Florida, pon the plan submitted by Lieutenant William M. Black, United States Army Enineers, under date of May thirty-first, eighteen hundred and eighty-seven; the said board shall report to the Secretary of War, who shall lay its report before Congress t its next session, together with the views of himself and the Chief of Engineers of he United States Army thereon.

Improving harbor at Mobile, Alabama: Continuing improvement, on enlarged project for securing a channel twenty-three feet deep and two hundred and eighty feet ide, two hundred and fifty thousand dollars.

Improving harbor at Biloxi Bay, Mississippi: Continuing improvement, eighteen housand five hundred dollars.

Improving Aransas Pass and Bay up to Rockport and Corpus Christi, Texas: Connuing improvement, one hundred thousand dollars.

Improving Brazos, Santiago Harbor, Texas: Continuing improvement, twenty-five housand dollars.

Improvement of entrance to Galveston Harbor, Texas: Continuing improvement, ve hundred thousand dollars.

Improving Sabine Pass, and Blue Buck Bar, Texas: Continuing improvement, two undred and fifty thousand dollars.

Improving ship-channel in Galveston Bay, Texas, from Morgan's Cut to Bolivar hannel: Continuing improvement, one hundred thousand dollars.

Improving harbor at Ashtabula, Ohio: Continuing improvement, twenty-five thouand dollars.

Improving harbor at mouth of Black River, Ohio: Continuing improvement, ten ousand dollars.

Improving harbor at Cleveland, Ohio: Continuing improvement on the last plan ojected, one hundred thousand dollars.

Improving harbor at Fairport, Ohio: Continuing improvement, ten thousand dollars; of which so much as may be necessary may be expended in deepening the ri That the owners of dock property abutting on Grand River, at the mouth ther shall have the right to load and unload coal, ore, and other freight over so much the east Government pier as lies north of the present low-water mark, under su limitations as to time and use as shall be approved by the Secretary of War, on th payment of such compensation as the Secretary of War shall determine.

Improving harbor at Huron, Ohio: Continuing improvement, six thousand dolla

Improving harbor at Vermillion, Ohio: For preservation of piers, one thous dollars.

For ice-harbor at the mouth of Muskingum River, Ohio: To complete, sixty th sand dollars.

Improving harbor at Port Clinton, Ohio: Continuing improvement, five thous dollars.

Improving harbor at Sandusky, Ohio: Continuing improvement by a straight cha nel from Sandusky City to the entrance of Sandusky Bay, pursuant to the last pl of the engineers, forty thousand dollars; of which five thousand dollars, or so mu as may be necessary, may be used, in the discretion of the Secretary of War, in im proving the old channel.

Improving harbor at Toledo, Ohio: Continuing improvement of the Maumee Riv by a straight channel, pursuant to the last plan of the engineer in charge, one hund and fifty thousand dollars.

Improving harbor at Toledo, Ohio: For clearing the old channel, five thous dollars.

Improving outer harbor at Michigan City, Indiana: Continuing improvem ninety thousand dollars.

To complete inner harbor at Michigan City, five thousand dollars.

Improving harbor at Calumet, Illinois: To complete improvement, twenty th sand four hundred dollars.

Improving harbor at Chicago, Illinois: Continuing improvement, two hund thousand dollars.

Improving harbor at Waukegan, Illinois: Continuing improvement, twenty-fi thousand dollars.

Improving harbor at Charlevoix and entrance to Pine Lake, Michigan, twelve th sand five hundred dollars.

Improving harbor at Cheboygan, Michigan: Continuing improvement, fifteen th sand dollars.

Improving harbor at Frankfort, Michigan: Continuing improvement, eight th sand dollars.

Improving harbor at Grand Haven, Michigan: Continuing improvement, twe five thousand dollars.

Improving harbor of refuge at Grand Marais, Michigan: Continuing improvem fifty thousand dollars.

Improving harbor of refuge at Ludington, Michigan: Continuing improvem sixty thousand dollars; and the Secretary of War is hereby authorized and direc to accept the deed tendered by the Pere Marquette Lumber Company, of Ludingto Michigan, of three and thirty-one hundredths acres of land.

Improving harbor at Manistee, Michigan: Continuing improvement, ten thous dollars.

Improving harbor at Black Lake, Michigan: Continuing improvement, five th sand dollars.

Improving harbor at Monroe, Michigan: For repairs and for dredging at mouth river, five thousand dollars.

Improving harbor at Muskegon, Michigan: Continuing improvement, forty-fi thousand dollars.

Improving harbor at Ontonagon, Michigan: Continuing improvement, twelve th sand five hundred dollars.

Improving harbor at Pentwater, Michigan: Continuing improvement, eight th sand dollars.

Improving harbor of refuge at Portage Lake, Michigan: Continuing improvem ten thousand dollars.

Improving harbor of refuge at Sand Beach, Michigan: Continuing improvem seventy thousand dollars.

Improving harbor at Saint Joseph, Michigan: Continuing improvement, tw thousand dollars; five thousand dollars to be used in improving the water cha leading up to Benton Harbor.

Improving harbor at Saugatuck, Michigan: To repair and maintain, five thous dollars.

Improving harbor at South Haven, Michigan: Continuing improvement, ten th sand dollars; three thousand dollars of which shall be used in deepening the cha of Black River from the inner termini of the piers to the highway bridge.

Improving harbor at White River, Michigan: Continuing improvement, ten thousand dollars.

Improving harbor at Marquette, Michigan: Continuing improvement, twenty-five thousand dollars: *Provided*, That no part of this appropriation shall be expended until the question of harbor limits has been settled to the satisfaction of the Secretary of War.

Improving harbor at Thunder Bay, Michigan: Continuing improvement, the balance available from former appropriations shall be expended in dredging the entrance channel from the bay into the river.

Improving harbor at Au Sable, Michigan: Continuing improvement, the balance available from former appropriations shall be expended in dredging the mouth of Au Sable River.

Improving harbor at Ahnapee, Wisconsin: Continuing improvement, five thousand dollars; and so much of the act of August fifth, eighteen hundred and eighty-six, for the improvement of rivers and harbors as relates to the harbor of Ahnapee is hereby amended by striking out the words "but no part of said sum is to be expended until the wharfage over the Government pier at that port shall be made free."

Improving harbor at Green Bay, Wisconsin: Continuing improvement, ten thousand dollars.

Improving harbor at Kenosha, Wisconsin: Continuing improvement, seven thousand five hundred dollars.

Improving harbor at Kewaunee, Wisconsin: Continuing improvement, ten thousand dollars.

Improving harbor at Manitowoc, Wisconsin: Continuing improvement, eight thousand dollars.

Improving harbor at Menomonee, Wisconsin: For repairs and dredging, nine thousand dollars.

Improving harbor of refuge at Milwaukee, Wisconsin: Continuing improvement on bay and harbor, seventy thousand dollars.

Improving harbor at Milwaukee, Wisconsin: Continuing improvement, ten thousand dollars.

Improving harbor at Oconto, Wisconsin: Continuing improvement, twenty thousand dollars; eighteen thousand dollars of which appropriation shall not be available until the city of Oconto has caused repairs to be made, to the satisfaction of the engineer in charge, to the old part of the pier built by private enterprise.

Improving harbor at Port Washington, Wisconsin: Continuing improvement, five thousand dollars.

Improving harbor at Racine, Wisconsin: Continuing improvement, ten thousand dollars.

Improving harbor at Superior Bay and Saint Louis Bay, Wisconsin: Continuing improvement, fifty thousand dollars.

Improving harbor at Sheboygan, Wisconsin: Continuing improvement, fifteen thousand dollars.

Improving harbor at Ashland, Wisconsin: Continuing improvement on the enlarged project, sixty thousand dollars.

Improving harbor at Two Rivers, Wisconsin: Continuing improvement, two thousand five hundred dollars.

Improving harbor at Duluth, Minnesota: Continuing improvement, eighty thousand dollars; of which sum one-half shall be expended on the harbor basin and new channel east of Rice's Point, and in the preservation and maintenance of the canal and piers at the harbor entrance, and in the purchase of a steam launch; and the other half of said sum shall be expended on the channel west of Rice's Point, and from thence along the northern shore of Saint Louis Bay to Grassy Point; and the Government of the United States hereby accepts from the city of Duluth the grant and conveyance made by said city, by deed dated January ninth, eighteen hundred and eighty-eight, of the following described real estate, to wit: All the tract or parcel of land lying and being in the county of Saint Louis and State of Minnesota described as follows, to wit: Lots two hundred and forty-seven, two hundred and forty-eight, two hundred and forty-nine, two hundred and fifty, two hundred and fifty-one, two hundred and fifty-two, two hundred and fifty-three, two hundred and fifty-four, two hundred and fifty-five, two hundred and fifty-six, two hundred and fifty-seven, two hundred and fifty-eight, two hundred and fifty-nine, and two hundred and sixty Minnesota avenue, Upper Duluth, the same being the ground on which is located the canal entrance and piers to the harbor of Duluth.

Improving harbor at Grand Marais, Minnesota: Continuing improvement, fifteen thousand dollars.

Improving harbor at Agate Bay, Minnesota: Continuing improvement, fifteen thousand dollars.

Improving harbor and bay at Humboldt, California: Continuing improvement, one hundred and twenty-five thousand dollars: *Provided*, That no part of said sum shall be expended until the twelve acres of land necessary to said improvement shall have been conveyed to the United States free of expense, and such conveyance has been approved by the Secretary of War, after the Attorney-General of the United States shall have certified to the Secretary of War that the title is perfect.

Improving harbor at Oakland, California: Continuing improvement, three hundred and fifty thousand dollars; which sum, or any part thereof, may be used in the discretion of the Secretary of War, on the training-walls and channel.

Improving harbor at Red Wood, California: To complete, seven thousand five hundred dollars.

Improving harbor at Wilmington, California: Continuing improvement, ninety thousand dollars.

Improving harbor at San Diego, California: For repairs, one thousand dollars.

Improving harbor at San Luis Obispo, California, by the construction of a breakwater on the reef to the plane of mean low water, according to the plan of W. H. Benyaurd, major of engineers, dated January twenty-eighth, eighteen hundred and eighty-seven, twenty-five thousand dollars.

Improving entrance to harbor at Coos Bay, Oregon: Continuing improvement, fifty thousand dollars.

Improving harbor at Yaquina Bay, Oregon: Continuing improvement, one hundred and fifty thousand dollars.

Improving Tillamook Bay and Bar, Oregon, five thousand two hundred dollars.

Improving Lubec Channel, Maine: Continuing improvement, twenty thousand dollars.

Improving Penobscot River, Maine: Continuing improvement, fifty thousand dollars; twenty thousand dollars of which sum to be expended between Bangor and Crosby's Narrows, and thirty thousand dollars between Bucksport and Winterport according to the last plan of the engineer in charge if approved by the Secretary of War.

Improving Narraguagus River, Maine: Continuing improvement, ten thousand dollars.

Improving Saco River, Maine: Continuing improvement, ten thousand dollars.

Improving Bagaduce River, Maine, three thousand dollars.

Improving Kennebec River, Maine, seventy-five thousand dollars.

Improving Moose-a-Bec Bar, Maine: Continuing improvement, fifteen thousand dollars.

Improving Cocheco River, New Hampshire: To complete, nine thousand dollars.

Improving Bellamy River, New Hampshire, ten thousand dollars.

Improving Otter Creek, Vermont: Continuing improvement, two thousand five hundred dollars.

Improving Ipswich River, Massachusetts, two thousand five hundred dollars.

Improving Powow River, Massachusetts, for dredging, three thousand dollars: *Provided*, That this sum shall not be expended until the towns of Amesbury and Salisbury, or either of them, shall have caused such a draw to be placed in the present bridge over said river, as may be approved by the Secretary of War.

Improving Pawtucket River, Rhode Island: Continuing improvement, thirty-five thousand dollars.

Improving Providence River and Narragansett Bay, Rhode Island: Continuing improvement, forty thousand dollars.

For removing Green Jacket Shoal, Providence River, Rhode Island: Continuing improvement, twenty-eight thousand dollars.

Improving Pawcatuck River, Rhode Island: Continuing improvement, ten thousand dollars.

Improving Connecticut River below Hartford, Connecticut: Continuing improvement, ten thousand dollars.

Improving Housatonic River, Connecticut, thirty-five thousand dollars; twenty-five thousand dollars of which may be expended in commencing the construction of a breakwater at the mouth of said river.

Improving Thames River, Connecticut: Continuing improvement, fifty thousand dollars, which may be expended at any point between Norwich and New London.

Improving East Chester Creek, New York: Continuing improvement, five thousand dollars.

Improving Hudson River, New York: Continuing improvement, seventy-five thousand dollars; of which ten thousand dollars may be used in dredging and otherwise deepening and improving the harbor at Peekskill.

Improving Newtown Creek and Bay, New York: Continuing improvement, twenty-five thousand dollars, a portion of which may, in the discretion of the Secretary of War, be applied to the improvement of the west branch of Newtown Creek.

Improving Ticonderoga River, New York: Continuing improvement, two thousand five hundred dollars.

Improving Harlem River, New York, seventy thousand dollars.

Improving East River and Hell Gate, New York: Removing obstructions, two undred and fifty thousand dollars.

Improving Narrows at Lake Champlain, New York, from Benson, Vermont, to canal cks at Whitehall, New York, fifteen thousand dollars.

Improving Grass River at Massena, New York: The Secretary of War is authorized nd directed to expend the balance remaining on hand of the sum heretofore approriated in dredging operations according to the original plan.

Improving Maurice River, New Jersey: Continuing improvement, ten thousand ollars.

Improving Passaic River, New Jersey: Continuing improvement, thirty-five thousand dollars; of which seven thousand five hundred dollars are to be used to comlete improvement above Newark.

Improving Raritan River, New Jersey: Continuing improvement, fifty thousand ollars.

Improving Shrewsbury River, New Jersey: Continuing improvement, ten thousand ollars.

Improving South River, New Jersey: Continuing improvement, five thousand dolars.

Improving Allegheny River, Pennsylvania: Continuing improvement, twenty-five housand dollars.

Improving Schuylkill River, Pennsylvania: Continuing improvement, twenty-five housand dollars.

Improving Delaware River, Pennsylvania and New Jersey: Continuing improvement from Trenton to its mouth, two hundred and fifty thousand dollars; of which en thousand dollars is to be expended upon said river and its tidal tributaries between ooper's Creek and Trenton.

For continuation of construction of the dam at Herr's Island, in the Allegheny iver, near Pittsburgh, Pennsylvania, thirty-five thousand dollars; and the Secreary of War is hereby authorized to purchase the lands required for said dam and its ppurtenances, or, at his discretion, to cause suit to be instituted for the condemnaion of such lands as may be necessary therefor; and said sum of thirty-five thousand ollars, or so much thereof as may be necessary, is hereby made available for paying or said lands, whether procured by purchase or by condemnation, as authorized by he act of the legislature of Pennsylvania approved May eighteenth, eighteen hunlred and eighty-seven.

Improving Saint Jones River, Delaware: Continuing improvement, fifteen thouand dollars.

Improving Duck Creek, Delaware, by dredging, ten thousand dollars.

Improving Mispillion Creek, Delaware: To complete from Milford to its mouth, hree thousand five hundred dollars.

Improving Broadkiln River, Delaware: Continuing improvement, ten thousand dollars.

Improving Broad Creek, Delaware: Continuing improvement, five thousand dollars.

Improving Choptank River, Maryland: Continuing improvement, seven thousand ive hundred dollars.

Improving Corsica River, Maryland: Continuing improvement, ten thousand dolars.

Improving Susquehanna River, Maryland and Pennsylvania: Continuing improvement, ten thousand dollars, to be expended above the Philadelphia, Wilmington and Baltimore Railroad bridge.

Improving Fairlee Creek or Inlet, Maryland, five thousand dollars.

Improving Patuxent River, Maryland, five thousand dollars.

Improving Potomac River at Washington: Continuing improvement, three hundred thousand dollars.

Improving Appomattox River, Virginia: Continuing improvement, fifteen thousand dollars; and the Chief of Engineers is directed to cause to be examined and surveyed, and the cost estimated, for diverting the water of the river above the harbor at Petersburgh to the old North Channel, and report upon the same.

Improving Chickahominy River, Virginia: Continuing improvement, two thousand five hundred dollars.

Improving James River, Virginia: Continuing improvement below Richmond, two hundred and twenty-five thousand dollars.

Improving Mattaponi River, Virginia: Continuing improvement, three thousand dollars.

Improving channel at Mount Vernon: Continuing improvement, six thousand dollars.

Improving Nomini Creek, Virginia: Continuing improvement, five thousand dollars.

Improving Pamunky River, Virginia: Continuing improvement, three thousand dollars.

Improving Rappahannock River, Virginia: Continuing improvement, fifteen thousand dollars; of which three thousand dollars may, in the discretion of the Secretary of War, be used in continuing the improvement of Urbana Creek, a tidal tributary thereof.

Improving Staunton River, Virginia: Continuing improvement, five thousand dollars.

Improving York River, Virginia: Continuing improvement, thirty thousand dollars.

Improving, by dredging and otherwise, the inland water-way, from Chincoteague Bay, Virginia, to Delaware Bay, at or near Lewes, Delaware, to be used from Chincoteague Bay to Indian River Bay: Continuing improvement, fifty thousand dollars, no part of which shall be expended until the right of way is secured free of cost to the United States.

Improving Nansemond River, Virginia, including the mouths of Bennett and Chuckatuck Creeks, ten thousand dollars.

Improving Big Sandy River, West Virginia and Kentucky: Continuing improvement, thirty-one thousand five hundred dollars.

Improving Elk River, West Virginia: Continuing improvement, three thousand dollars.

Improving Buckhannon River, West Virginia: Continuing improvement, one thousand five hundred dollars.

Improving Great Kanawha River, West Virginia: Continuing improvement, three hundred and fifty thousand dollars.

Improving Guyandotte River, West Virginia: Continuing improvement, two thousand dollars.

Improving Little Kanawha River, West Virginia: Continuing improvement, twenty-five thousand dollars; but no toll shall be collected by any person or corporation for this improved navigation; and such right, if any exist, shall be relinquished in a manner satisfatory to the Secretary of War before the expenditure of any of the money herein appropriated for this work.

Improving Monongahela River, West Virginia: To complete dam number eight, thirty-five thousand dollars; and for continuing improvements.

The Secretary of War be, and he is hereby, authorized and directed to negotiate for and purchase, at a cost not to exceed one hundred and sixty-one thousand seven hundred and thirty-three dollars and thirteen cents, lock and dam number seven, otherwise known as "the Upper Lock and Dam," and its appurtenances, of the Monongahela Navigation Company, a corporation organized under the laws of Pennsylvania, which lock and dam number seven and its appurtenances constitute a part of the improvements in water communication in the Monongahela River, between Pittsburgh, in the State of Pennsylvania, and a point at or near Morgantown, in the State of West Virginia. And the sum of one hundred and sixty-one thousand seven hundred and thirty-three dollars and thirteen cents, or so much thereof as may be necessary, is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, for consummating said purchase, the same to be paid on the warrant of the Secretary of War, upon full and absolute conveyance to the United States of the said lock and dam number seven, and its appurtenances, of the said Monongahela Navigation Company.

In the event of the inability of the Secretary of War to make voluntary purchase of the said lock and dam number seven and its appurtenances for said sum of one hundred and sixty-one thousand seven hundred and thirty-three dollars and thirteen cents, or a less sum, then the Secretary of War is hereby authorized and directed to institute and carry to completion proceedings for the condemnation of said lock and dam number seven and its appurtenances, said condemnation proceedings to be as prescribed and regulated by the provisions of the general railroad law of Pennsylvania approved February nineteenth, eighteen hundred and forty-nine, and its supplements except that the United States shall not be required to give any bond, and except that jurisdiction of said proceedings is hereby given to the circuit court of the United States for the western district of Pennsylvania, with right of appeal by either party to the Supreme Court of the United States: *Provided*, That in estimating the sum to be paid by the United States, the franchise of said corporation to collect tolls shall not be considered or estimated; and the sum of five thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any moneys in the Treasury not otherwise appropriated, to pay the necessary costs of said condemnation proceedings; and upon final judgment being entered therein the Secretary of War is hereby authorized and directed to draw his warrant on the Treasury for the amount of said judgment and costs, and said amount for the payment thereof is hereby appropriated out of any moneys in the Treasury not otherwise appropriated. And when said lock and dam number seven and its appurtenances shall have been acquired by the United States, whether by purchase or condemnation, the Secretary of War shall take charge thereof, and the same shall thereafter be subject to the proons of section four of an act entitled "An act making appropriations for the con- ction, repair, and preservation for certain public work on rivers and harbors, and other purposes," approved July fifth, eighteen hundred and eighty-four.

he Secretary of War is authorized and directed to appoint a board of three engi- r officers of the United States Army, whose duty it shall be to thoroughly examine Ohio River below Pittsburgh, as to the practicability of the improvement of the igation of said river by means of movable dams; and said board shall report on efore the first Monday of December next, as to the feasibility and advisability of h project of improvement, the number of dams required, their location, with the t of the same, together with the cost of maintaining them after the completion of project. The Secretary of War shall transmit said report to Congress at its next sion, together with the views of himself and the Chief of Engineers of the United tes Army thereon.

he sum of ten thousand dollars, or so much thereof as may be necessary, is hereby propriated out of any money in the Treasury not otherwise appropriated to pay expenses of said board and survey.

mproving Gauley River, West Virginia: For cleaning out channel, three thousand llars.

mproving New River, West Virginia: Continuing improvement from mouth of ilson Creek to mouth of Greenbrier River, balance now available from former ap- iations for improving New River, Virginia, is hereby directed to be spent in im- oving said river between Ivanhoe Furnace in Wythe County and mouth of Wilson eek.

Improving Cape Fear River, North Carolina, above Wilmington: Continuing im- ovement, twelve thousand dollars.

To complete the improvement of Cape Fear River below Wilmington, North Caro- ia, two hundred and forty-five thousand dollars.

Improving Contentnia Creek, North Carolina: Continuing improvement, five ousand dollars.

Improving Currituck Sound, Coanjok Bay, and North River Bar, North Carolina, ven thousand five hundred dollars.

Improving Neuse River, North Carolina: Continuing improvement, fifteen thousand llars.

Improving New River, North Carolina: Continuing improvement, three thousand llars.

Improving Pamlico and Tar rivers from the mouth to the Falls at Rocky Mount, rth Carolina: Continuing improvement, ten thousand dollars.

Improving Trent River, North Carolina: Continuing improvement, five thousand llars.

Improving Lumber River, North Carolina, five thousand dollars.

Improving Roanoke River, North Carolina, from its mouth to Clarksville, Virginia, rty thousand dollars.

Improving Yadkin River, North Carolina, ten thousand dollars.

Improving Edisto River, South Carolina: Continuing improvement, five thousand llars.

Improving Great Pee Dee River, South Carolina: Continuing improvement, twenty ousand dollars.

Improving Salkehatchee River, South Carolina: Continuing improvement, three ousand dollars.

Improving Santee River, South Carolina: Continuing improvement, twenty-four ousand dollars.

Improving Waccamaw River, North and South Carolina, to Waccamaw Lake, North arolina: Continuing improvement, fifteen thousand dollars.

Improving Wappoo Cut, South Carolina: Continuing improvement, five thousand llars.

Improving Wateree River, South Carolina: Continuing improvement, twelve thou- nd dollars: *Provided*, That no part of said appropriation shall be expended until e Wilmington, Columbia and Augusta Railroad Company, and the Camden branch f the South Carolina Railroad Company, shall have built suitable draw-spans in their ridges over said river, to be approved by the Secretary of War.

Improving Congaree River, South Carolina: Continuing improvement, seven thou- and five hundred dollars: *Provided*, That no part of said appropriation shall be ex- ended until the South Carolina Railroad Company shall have built a suitable draw- pan in its bridge over said river, to be approved by the Secretary of War.

Improving Mingo Creek or River, South Carolina, five thousand dollars.

Improving Clark Creek or River, South Carolina, two thousand five hundred dol- ars.

Improving Little Pee Dee River, South Carolina, five thousand dollars.

Improving Altamaha River, Georgia: Continuing improvement, ten thousand dol- ars.

Improving Chattahoochee River, Georgia: Continuing improvement, twenty thousand dollars.

Improving Coosa River, Georgia and Alabama: Continuing improvement, six thousand dollars.

Improving Flint River, Georgia: Continuing improvement, twenty thousand dollars; of which sum five thousand dollars are to be expended between Albany and Montezuma, and fifteen thousand below Albany.

Improving Ocmulgee River, Georgia: Continuing improvement, fifteen thousand dollars.

Improving Oconee River, Georgia: Continuing improvement, twelve thousand five hundred dollars; a portion of which may be expended on said river between Skull Shoals and the Georgia railroad bridge.

Improving the Savannah River, Georgia, betweeen the cities of Augusta and Savannah, completing the present project and commencing the extended project contained in the report of Engineer for year ending June thirtieth, eighteen hundred and eighty-seven, twenty-one thousand dollars.

Improving Jekyl Creek, Georgia, five thousand dollars.

Romerly Marsh, Georgia: To pay for completing the existing project four thousand six hundred and thirty-three dollars and seventy-seven cents.

Improving Apalachicola River, Florida: To maintain, two thousand dollars.

Improving Caloosahatchie River, Florida: To complete improvement of upper river ten thousand dollars.

Improving Choctawatchie River, Florida and Alabama: Continuing improvement ten thousand dollars.

Improving Escambia and Conecuh Rivers, Florida and Alabama: Continuing improvement, ten thousand dollars.

Improving La Grange Bayou, Florida: To complete, three thousand dollars, including Holmes River to the town of Vernon.

Improving Manatee River, Florida: Continuing improvement, five thousand dollars.

Improving Saint John's River, Florida, from Jacksonville to the ocean including the channel over the bar at the mouth, one hundred and seventy-five thousand dollars.

Improving Suwanee River, Florida: Continuing improvement, fifteen thousand dollars; of which ten thousand dollars is to be expended in the purchase or construction of a suitable steam snag-boat with dredging and pile-driving machinery to be used on the rivers of the west coast of Florida.

Improving Volusia Bar, Florida: To maintain, five hundred dollars.

Improving Withlacoochee River, Florida: Continuing improvement, five thousand dollars.

Improving Alabama River, Alabama: Continuing improvement, twenty thousand dollars.

Improving Black Warrior River, Alabama, from Tuscaloosa to Daniel's Creek: Continuing improvement, one hundred thousand dollars.

Improving Tallapoosa River, Alabama: Continuing improvement, seven thousand five hundred dollars.

Improving Warrior River, below Tuscaloosa, Alabama: Continuing improvement eighteen thousand dollars.

Improving Tombigbee River, Alabama, from Walker's Bridge to Fulton, four thousand dollars.

Improving Tombigbee River, Alabama, from Fulton to Vienna: Continuing improvement, six thousand five hundred dollars.

Improving Tombigbee River, Alabama, below Vienna: To complete improvement six thousand dollars.

Improving Big Sunflower River, Mississippi: Continuing improvement, five thousand dollars; of which two thousand dollars to be expended between Woodburn and Lehrton.

Improving Noxubee River, Mississippi: Continuing improvement, five thousand dollars.

Improving Pascagoula River, Mississippi: Continuing improvement, twenty-seven thousand dollars, including bar at the mouth and from there to the mills at Moss Point.

Improving Pearl River, Mississippi, between Edinburgh and Carthage: Continuing improvement, five thousand dollars.

Improving Pearl River, Mississippi, between Carthage and Jackson: Continuing improvement, two thousand five hundred dollars.

Improving Pearl River, Mississippi, below Jackson, fifteen thousand dollars; of which five thousand shall be used for dredging at the mouth.

Improving Steele's Bayou, Mississippi, including Washington Bayou: Continuing improvement, two thousand five hundred dollars.

Improving Tallahatchie River, Mississippi: Continuing improvement, five thousand dollars.

Improving Tchula Lake, Mississippi: Continuing improvement, three thousand dollars.

Improving Yazoo River, Mississippi: Continuing improvement, thirty-two thousand dollars; of which ten thousand shall be used in repairing snag-boat Meigs, and eight thousand for constructing a pumping dredge-boat.

Improving Amite River, Louisiana: Continuing improvement, five thousand dollars; of which two thousand five hundred may be used in improving Bayou Manchae.

Improving Bœuf River, Louisiana: Continuing improvement and closure of outlets, six thousand dollars.

Improving Bayou Bartholomew, Louisiana and Arkansas: Continuing improvement, five thousand dollars.

Improving Bayou Courtableau, Louisiana: Continuing improvement, five thousand dollars.

Improving Bayou D'Arbonne, Louisiana: Continuing improvement, two thousand dollars.

Improving Bayou Terre Bonne, Louisiana: To complete, three thousand dollars.

Improving Red River, Louisiana: For completion of survey from Fulton, Arkansas, to the Atchafalaya River, thirty-five thousand dollars.

Improving Tensas River and Bayou Macon, Louisiana: Continuing improvement, five thousand dollars.

Improving Red River, Louisiana and Arkansas: Continuing improvement from Fulton, Arkansas, to Atchafalaya River, including completing the work at Alexandria, sixty-five thousand dollars; of which five thousand dollars, or so much thereof as may be necessary, to be used upon Cypress Bayou and the lakes between Shreveport, Louisiana, and Jefferson, Texas; and five thousand dollars or so much thereof as may be necessary, upon Bayou Dorcheat.

Improving Ouachita and Black River, Arkansas and Louisiana: Continuing improvement, twenty thousand dollars; of which four thousand five hundred dollars is authorized to be expended for the construction or purchase of a crane-boat with steam power.

Improving Tickfaw River and its navigable tributaries, Louisiana: Continuing improvement, one thousand dollars.

Improving Little River, Louisiana, two thousand five hundred dollars.

Improving Bayous Rondeway and Vidal, Louisiana, by removing obstructions, one thousand dollars.

Improving Calcasieu River and Passes, Louisiana: Continuing improvement at the entrance to said river and pass, ten thousand dollars.

Improving Bayou Plaquemine, Louisiana: For securing a navigable channel sixty feet wide and six feet in depth, from deep water up to the Plaquemine Dike, and for securing the mouth of the bayou from further caving, one hundred thousand dollars, pursuant to plan recommended by the engineers.

Improving Bayou Lafourche, Louisiana, pursuant to the project of Lieutenant O. T. Crosby, Corps of Engineers, dated June eleventh, eighteen hundred and eighty-six, fifty thousand dollars, including immediate dredging to secure low-water navigation.

Improving Buffalo Bayou, Texas: Continuing improvement, twenty-five thousand dollars.

Improving Trinity River, Texas: Continuing improvement, twelve thousand five hundred dollars.

Improving Arkansas River, Arkansas: Continuing improvement, one hundred and fifty thousand dollars: *Provided*, That nothing herein contained shall authorize the Secretary of War to enter upon the project of improvement of said river as set forth in the report of the Board of Engineers on improvement of the Arkansas River from Wichita, Kansas, to its mouth, dated New York City, March sixteenth, eighteen hundred and eighty-eight, and contained in House Executive Document Number Two hundred and thirty-four, first session, Fiftieth Congress: *Provided*, That the Secretary of War shall expend the appropriation under this head with reference to the final improvement of this river as contemplated in the report of the Chief of Engineers for the year ending July first, eighteen hundred and eighty-five, and as authorized in the act for the improvement of rivers and harbors approved August fifth, eighteen hundred and eighty-six, and in House Executive Document number ninety, Forty-ninth Congress, first session; said methods to be applied, as the Secretary of War may direct, at such points between Wichita, Kansas, and the navigable mouth of the Arkansas River, at its junction with the Mississippi River, as he may deem for the best interest of commerce. And all moneys now to the credit of different sections of the Arkansas River, other than appropriations for the operating of snag-boats, shall be available for use under this head; and in future the engineer in charge of this work and the Secretary of War shall make report upon the progress and needs of this work under this head, instead of reporting upon disconnected projects, as heretofore. Nothing herein contained shall be understood to prevent the Secretary War from applying any part or all of the funds previously appropriated for Fort Smith, Dardanelle, in Pine Bluff Reach, or from expending not exceeding thousand dollars to remove the bar in front of Van Buren, or from allotting no ceeding eight thousand dollars as a contingent fund for the expenditure in Pine Reach.

Improving Saint Francis River, Arkansas: Continuing improvement, four thous dollars.

Improving Arkansas River, Arkansas: For removing obstructions, twenty-f thousand dollars, of which ten thousand dollars is authorized to be used in constr ing a new hull for the snag-boat Wichita, including capstans and the transfer of upper works, and three hundred and seventy-five dollars in completing survey maps.

Improving Red River, Arkansas: To complete improvement above Fulton, th thousand dollars.

Improving Black River, Arkansas and Missouri: Continuing improvements, f thousand dollars.

Improving Little Red River, Arkansas: Continuing improvement, five thous four hundred dollars; a portion of which is authorized to be expended in the p chase or construction of a dredge-boat suitable for the work of the river.

Improving Petit Jean River, Arkansas: Continuing improvement, below the bridge at the Rocky Crossing, two thousand five hundred dollars.

Improving White River, Arkansas: Continuing improvement, twenty-five th sand dollars.

Improving Ouachita River, Arkansas, above Camden: To complete, nine thous dollars.

Improving Cache River, Arkansas, seven thousand dollars; three thousand dol of which shall be expended for the building and equipping of a small hand-propel snag-boat, and four thousand dollars for running expenses of the same, in accordan with the recommendation of the engineer in charge.

Improving Big Hatchee River, Tennessee: Continuing improvement, five thous dollars.

Improving Caney Fork River, Tennessee: Continuing improvement, two thous five hundred dollars.

Improving Clinch River, Tennessee: Continuing improvement, five thousand d lars.

Improving Cumberland River, Tennessee and Kentucky: Continuing improvem above Nashville, two hundred thousand dollars; with a view to secure a uniform dep in the channel of four feet, commencing with a lock at or near the lower island Nashville.

Improving Cumberland River, Tennessee and Kentucky, below Nashville: Co tinuing improvement, ten thousand dollars.

Improving French Broad River, Tennessee: Continuing improvement, ten thous dollars.

Improving Hiawassee River, Tennessee: Continuing improvement, one thous dollars.

Improving Forked Deer River, Tennessee: Continuing improvement, four thous five hundred dollars for the North Fork, below Dyersburgh; two thousand five hu dred for South Fork; and two thousand five hundred for main river below.

Improving Tennessee River, above Chattanooga, Tennessee: Continuing impro ment, fifteen thousand dollars.

Improving Tennessee River, below Chattanooga, Tennessee: Continuing impro ment, two hundred and fifty thousand dollars; of which as much as may be necess is authorized to be expended in acquiring by purchase or condemnation the la needed for the sites of the permanent buildings necessary in the management of t canals at the improved shoals.

Improving Kentucky River, Kentucky: Continuing improvement, one hundred a eighty thousand dollars.

Improving Licking River, Kentucky, from Farmer's to West Liberty, three thou sand dollars.

Improving Tradewater River, Kentucky: To complete improvement, six thous dollars.

For the purchase of the improvements known as the Green and Barren River im provements, one hundred and thirty-five thousand dollars: *Provided*, That no part said sum shall be expended until a full and absolute conveyance of said impro ments, together with rights of way, easements, piers, docks, and appurtenances every nature belonging to or connected with said improvements, by the owner owners thereof, and the Attorney-General of the United States shall have certified the Secretary of War that the title is perfect.

Improving the Ohio River: Continuing improvement, three hundred and eigh housand dollars; of which sum, twenty-five thousand dollars, or so much thereof as ay be necessary, shall be expended in removing the rock obstruction at the mouth f Licking River, twenty thousand dollars, or so much thereof as may be necessary, hall be expended for the construction of a drift-gap at Davis Island Dam, with the ecessary bear-trap gates and masonry walls, and seven thousand five hundred dollars n constructing an ice-pier pursuant to the present or prospective plan of Chief of Engineers, at or near Portsmouth, Ohio: *Provided*, That the Secretary of War is hereby uthorized and directed to obtain, if he can do so without cost to the United States, perpetual lease or conveyance of the riparian rights of the property owners at said ocality, in the event said ice-pier shall be located where there is no landing place: *nd provided further*, That at said locality, if it be an improved landing, he shall first btain a relinquishment of wharfage rights and dues in favor of water craft seeking rotection from damage by ice; and no part of this appropriation shall be used for uch purpose until the foregoing conditions are complied with; and two thousand ive hundred dollars of said Ohio River appropriation may be used for improving the hannel in the mouth of the Big Hocking River below the first dam therein; and wenty thousand dollars of said Ohio River appropriation may be used for harbor improvement at Madison, Indiana, according to the plans heretofore submitted by Lieutenant-Colonel Merrill, Corps of Engineers; also out of said Ohio River appropriation the sum of fifteen thousand dollars may be expended in completing the construction of the embankment on the south side of the Great Miami River near its unction with the Ohio, to confine the waters of the Great Miami in great floods to he general course of its channel at or near the Ohio, to the end that the formation of he bar in the Ohio now obstructing navigation may be arrested; also out of said hio River appropriation the sum of fifteen thousand dollars may be expended in the onstruction, or aiding in the construction, of such an embankment at Shawneetown, llinois, as will confine the waters of the river in great floods to the general course of ts channel, and protect the harbor; and thirty thousand dollars of said sum of three hundred and eighty thousand dollars may be expended in protecting the harbor at Cairo, Illinois, in the discretion of the Secretary of War, if in the opinion of the Secretary of War the interests of commerce require it.

Improving the falls of the Ohio River: Continuing improvement, according to the last plan of the engineer in charge, one hundred and fifty thousand dollars; of which sum twenty-five thousand shall be used in enlarging the canal basin near the locks at Louisville, Kentucky, as recommended in the Engineer's Report of eighteen hundred and eighty-five, page one thousand eight hundred and four.

Improving Indiana Chute Fall, Ohio River: Continuing improvement, fifteen thousand dollars.

Improving Muskingum River, Ohio: For the construction of a lock at Taylorsville and the reconstruction of the lock at Zanesville, pursuant to the report of the engineers, one hundred and two thousand dollars; and the Secretary of War is hereby authorized and empowered to grant leases or licenses for the use of the water powers on the Muskingum River at such rate and on such conditions and for such periods of time as may seem to him just, equitable, and expedient: *Provided*, That the leases or licenses shall be limited to the use of the surplus water not required for navigation. And he is also empowered to grant leases or licenses for the occupation of such lands belonging to the United States on said Muskingum River as may be required for mill-sites or for other purposes not inconsistent with the requirements of navigation; and all moneys received under such leases or licenses shall be turned into the Treasury of the United States, and the itemized statement thereof shall accompany the annual report of the Chief of Engineers.

But nothing in this act shall be construed to affect any vested right, if such there be, of any lessee of water power on said river.

Improving Detroit River, Michigan: To complete, one hundred and thirty thousand and five hundred dollars.

Improving Hay Lake Channel, Michigan: Continuing improvement, five hundred thousand dollars: *Provided*, That any portion, or all of this sum may, in the discretion of the Secretary of War, be used in the work at the falls of the Saint Mary's River, in addition to the specific appropriation herein made for the latter.

Improving Saginaw River, Michigan: Continuing improvement, sixty-five thousand dollars, of which twenty-five thousand dollars are to be used above Bay City, and fifteen thousand dollars in improving the west channel along West Bay City.

Improving Saint Clair Flats Ship Canal, Michigan: Continuing improvement, seventy-five thousand dollars; all or any portion of which may, in the discretion of the engineer, be expended in dredging Grosse Pointe Channel.

Improving Saint Mary's River, at the Falls, Michigan: Continuing improvement on new lock, dam, and approaches, one million dollars.

Improving Clinton River, Michigan: Continuing improvement, ten thousand dollars; and the Secretary of War be, and is hereby, authorized to accept for the United States a conveyance of the parcel of land known as "Shoemaker's Bend," as per warranty deed from city of Mount Clemente to United States, under date of December twenty-ninth, eighteen hundred and eighty-seven, amounting to six and three-quarter acres, for the purpose of straightening the channel of Clinton River.

Improving Saint Joseph River, Michigan, from its mouth to Berrien Springs, ten thousand five hundred dollars.

Improving mouth of Black River, Michigan, ten thousand dollars.

Improving Rouge River, Michigan, at its junction with Detroit River, and up the river as far as the bridge of Saint Louis and Wabash Railroad, ten thousand dollars.

Improving Chippewa River, including Yellow Banks, in said river, Wisconsin: Continuing improvement, ten thousand dollars.

Improving Fox River, Wisconsin, below Montello, except as hereinafter provided: Continuing improvement, one hundred thousand dollars; of this sum five thousand dollars, or so much thereof as may be necessary, shall be used for deepening the said outlet of Lake Winnebago, at Neenah, Wisconsin, so as to make navigation practicable during low water season; six thousand dollars, or so much thereof as may be necessary, shall be expended in constructing a levee at Portage, Wisconsin, to prevent the overflow of the Wisconsin River into the Upper Fox River.

The sum of six thousand dollars, appropriated by the river and harbor act of August fifth, eighteen hundred and eighty-six, for a levee at Portage, Wisconsin, shall be available for that purpose; the sum of ten thousand dollars, appropriated by the river and harbor act of July fifth, eighteen hundred and eighty-four, "to be used in maintaining a channel between DePere and Green Bay, Wisconsin," shall be used, as soon as practicable, on the Lower Fox River, in buoying, straightening, and further deepening the channel of said river, between said cities.

Improving Saint Croix River, Wisconsin and Minnesota: Continuing improvement, ten thousand dollars.

Improving Red River of the North, Minnesota: Continuing improvement, twenty thousand dollars.

Improving Minnesota River, Minnesota, including protecting and holding the bank opposite the borough of Belle Plaine, so as to prevent the river from cutting through the narrow neck of land at that point and thereby changing its channel and course, ten thousand dollars.

Improving Wabash River, Indiana and Illinois, above Vincennes: Continuing improvement, five thousand dollars.

Improving Wabash River, Indiana and Illinois, below Vincennes: Continuing the work on lock and dam at Grand Rapids, near Mount Carmel, Illinois, fifty thousand dollars, and for continuing improvements, including the work at or near Grayville, ten thousand dollars.

Improving White River, Indiana: Continuing improvement, five thousand dollars: no part of which is to be expended until the bridges are so changed as not to obstruct navigation.

Improving Calumet River, Illinois and Indiana: Continuing improvement, fifty thousand dollars; of which fifteen thousand is to be used in improving the river above the Forks to one-half mile east of Hammond, and thirty-five thousand for the improvement of the river between its mouth and One hundred and eighth street.

The amount heretofore appropriated for the improvement of said Calumet River from its mouth to its Forks, or so much thereof as may be necessary, shall be immediately available for the improvement between its mouth and One hundred and eighth street, anything in the act of July fifth, eighteen hundred and eighty-four and August fifth, eighteen hundred and eighty-six to the contrary notwithstanding.

Improving Illinois River, Illinois: Continuing improvement, two hundred thousand dollars. And for the purpose of securing a continuous navigable water-way between Lake Michigan and the Mississippi River, having capacity and facilities adequate for the passage of the largest Mississippi River steam-boats, and of naval vessels suitable for defense in time of war, the Secretary of War is authorized and directed to cause to be made the proper surveys, plans, and estimates for a channel improvement and locks and dams in the beds of the Illinois and Desplaines Rivers from La Salle to Lockport, so as to provide a navigable water-way, not less than one hundred and sixty feet wide, and not less than fourteen feet deep, and to have surveyed and located a channel from Lockport to Lake Michigan, at or near the city of Chicago, such channel to be suitable for the purposes aforesaid; the necessary expenses of such surveys, estimates, plans, and location to be paid out of the sum herein appropriated for the improvement of the Illinois River.

The Secretary of War is further authorized and directed to cause to be located, on such line as he may approve, a canal from the Illinois River at or near the town of Hennepin to the Mississippi River at or above the mouth of Rock River, together with a necessary feeder for the same, said canal to be known as the Illinois and Mississippi Canal, and to be eighty feet wide at the water line, and to have a depth of not less than seven feet of water, with locks one hundred and seventy feet long and thirty feet wide. The Secretary of War shall cause to be made and submitted to Congress detailed plans and estimates for the construction of said canal and feeder; the necessary expense of making such location, plans, and estimates shall be paid out of the unexpended balance on hand heretofore appropriated for the survey of said canal by the River and Harbor act approved August fifth, eighteen hundred and eighty-six, for the examination of said canal, and of the Illinois and Michigan canal by a board of Engineers.

For continuing operations upon the reservoirs at the headwaters of the Mississippi River, twelve thousand dollars, to be expended in accordance with the recommendation of the Board of Engineers in their report to the Chief of Engineers, dated May twenty-fourth, eighteen hundred and eighty-seven. And it shall be the duty of the Secretary of War to prescribe such rules and regulations in respect to the use and administration of said reservoirs as in his judgment the public interest and necessity may require; which rules and regulations shall be posted in some conspicuous place or places for the information of the public. And any person knowingly and willfully violating such rules and regulations shall be liable to a fine not exceeding five hundred dollars, or imprisonment, not exceeding six months, the same to be enforced by prosecution in any district court of the United States within whose territorial jurisdiction such offense may have been committed. And the Secretary of War shall cause such gaugings to be made at or near Saint Paul during the annual operation of said reservoirs as shall determine accurately the discharge at that point, the cost of same to be paid out of the annual appropriation for gauging the waters of the Mississippi River and its tributaries.

For operating snag-boats and dredge-boats on Upper Mississippi River, twenty-five thousand dollars.

Improving the Mississippi River above Saint Anthony's Falls, ten thousand dollars.

Improving the Mississippi River from the landing on the west bank below the Washington avenue bridge, Minneapolis, to the Des Moines Rapids, including work for the protection of the bank of the Mississippi River at Winona, Minnesota, on account of the erosion caused by dams erected above the city to improve the navigation of the river, and the examination and survey at the Rock Island Rapids in said river hereinafter mentioned: Continuing improvement, six hundred thousand dollars.

And inasmuch as the present channel of the Mississippi River at the Rock Island Rapids is said to be of insufficient width and depth, and dangerous to the navigation of said river, the Secretary of War is hereby authorized and directed to cause an examination and survey to be made at said rapids, with the view of determining the best and most economical mode of securing a safer channel of greater width and depth, sufficient to meet the necessities of the commerce and navigation of the river, either by the construction of a canal around said rapids on the Illinois side of said river, from the head of the rapids near Rapids City, Illinois, on the most direct and feasible route to the main river, at the foot of said rapids, or by widening and deepening the present channel of the river at said rapids. And the Secretary of War shall cause a report of said examination and survey to be made to Congress at its next session, together with plans and estimates of the probable cost for the construction of such canal, or for the widening and deepening of the present navigable channel of the river, and with such plans and estimates, shall submit his opinion as to the best and most economical plan of improving the river at said rapids in the interest of the commerce and navigation of the river, and for the purpose of such examination and survey, so much of the above appropriation of six hundred thousand dollars as may be necessary is hereby authorized to be expended, not to exceed fifteen thousand dollars.

Improving the Mississippi River at Des Moines Rapids Canal under the modified project, thirty-five thousand dollars; and the Secretary of War is hereby authorized and directed to use so much of the money appropriated in the acts of July fifth, eighteen hundred and eighty-four, and August fifth, eighteen hundred and eighty-six, for the construction of a pier at the outer wall of the Des Moines Rapids Canal as may be necessary in the establishment of a floating boom, connecting said wall with the upper draw rest of the bridge at Keokuk, if in his opinion such work would adequately and advantageously serve the interests of navigation; and the balance left over of said appropriations of eighteen hundred and eighty-four and eighteen hundred and eighty-six, if any, to be used in continuing the improvement of the Des Moines Rapids under present project.

Improving Mississippi River from Des Moines Rapids to the mouth of Illinois River, two hundred thousand dollars, including the removal of bars at the mouth of Cedar Creek, in Quincy Bay, dredging in said bay; opening Willow Slough, and removing the bars at the mouth of Whipple Creek and Hamburg Bay, if in the opinion of the Secretary of War the same is deemed advisable in the interest of commerce and navigation; and fifty thousand dollars of said sum, or so much thereof as may be necessary may be expended in improving and strengthening Sny Island Levee where it crosses Sincarte Slough and other sloughs, and in repairing wash outs in said levee.

Improving dry-dock at Des Moines Rapids: To complete, sixteen thousand two hundred and fifty dollars.

Improving the Mississippi River from the mouth of the Illinois River to the mouth of the Ohio River, including the completion of the work at Alton, and at the discretion of the Secretary of War, the protection of the Illinois shore opposite the mouth of the Missouri River, and the improvement of Saint Louis harbor: Continuing improvement, three hundred thousand dollars.

Improving Mississippi River from head of the Passes to the mouth of the Ohio River: Continuing improvement, two million dollars; which sum shall be expended under the direction of the Secretary of War in accordance with the plans, specifications, and recommendations of the Mississippi River Commission: *Provided*, That no portion of this appropriation shall be expended to repair or build levees for the purpose of reclaiming lands or preventing injury to lands or private property by overflows: *Provided, however*, That the Commission is authorized to repair and build levees if in their judgment it should be done as part of their plans to afford ease and safety to the navigation and commerce of the river and to deepen the channel. Of the foregoing sum one hundred and fifty thousand dollars, or so much thereof as shall be necessary, shall be expended in protecting the bank along the Lake Bolivar front, by revetment.

For survey of the Mississippi River from the head of the passes to its headwaters: Continuing survey, seventy-five thousand dollars.

For continuing the removal of snags, wrecks, and other obstructions in the Mississippi River, one hundred thousand dollars.

For work in accordance with the plans and specifications of the Mississippi River Commission:

At Columbus, Kentucky: Continuing improvement, twenty-five thousand dollars.

At Hickman, Kentucky: Continuing improvement, seventy thousand dollars.

At Helena, Arkansas, seventy-five thousand dollars.

At Greenville, Mississippi: Continuing improvement, seventy-five thousand dollars.

At Vicksburg, Mississippi: Continuing improvement, one hundred and fifty thousand dollars.

At New Orleans, Louisiana: Continuing improvement, two hundred thousand dollars.

At the head of the Atchafalaya and mouth of Red River, Louisiana, for rectification thereof, by preventing further enlargement of the Atchafalaya and restricting its outlet capacity, and for turning the waters of Red River into the north or upper channel around Turnbull's Island, and for keeping open a navigable channel through the mouth of Red or Old River into the Mississippi, two hundred and fifty thousand dollars.

For gauging the waters of the Lower Mississippi River and its tributaries as provided for in joint resolution of twenty-first of February, eighteen hundred and seventy-one, nine thousand six hundred dollars: *Provided*, That three thousand six hundred dollars of same is authorized to be expended in paying the expenses of gauging the said waters during the fiscal year ending June thirtieth, eighteen hundred and eighty-eight.

For examinations and surveys at South Pass, mouth of Mississippi River, pursuant to the act of March third, eighteen hundred and seventy-five, ten thousand dollars.

Improving Gasconade River, Missouri: Continuing improvement, five thousand dollars.

Improving Little River, Missouri, from Hornersville to its junction with the Saint Francis River, five thousand dollars.

Improving Osage River, Missouri: Continuing improvement, five thousand dollars.

Improving Saint Francis River, Missouri, from Greenville to the Arkansas State line, five thousand dollars.

Improving Black River, Missouri, seven thousand dollars.

Improving Missouri River from mouth to Fort Benton: Continuing improvement, one million dollars, including removal of obstructions, surveys, and examinations, to be expended under the direction of the Secretary of War, in accordance with the plans, specifications, and recommendations of the Missouri River Commission, except as herein modified.

Out of the above sum the following amounts shall be applied to the purposes hereinafter specified, namely: One hundred and fifty thousand dollars, or so much thereof as may be needed, shall be expended on that portion of the Missouri River lying between the cities of Council Bluffs, Iowa, and Omaha, Nebraska, and a point five miles above the bridge of the Omaha and Council Bluffs Bridge Company, by the course of said river; that the sum of one hundred thousand dollars, or so much thereof as may be needed, shall be expended on said river at Sioux City, Iowa, and in Nebraska opposite said city; that the sum of fifty thousand dollars, or so much thereof as may be needed, shall be expended on said river at or near Plattsmouth, Nebraska; that the sum of fifty thousand dollars, or so much thereof as may be needed, shall be expended on said river at or near Rulo, Nebraska; that the sum of seventy-five thousand dollars, or so much thereof as may be needed, shall be expended on said river at or near Nebraska City, Nebraska; that the sum of sixty-five thousand dollars, or so much thereof as may be necessary, shall be expended on said river at or near Kansas City, Missouri; that the sum of sixty-five thousand dollars, or so much thereof as may be necessary, shall be expenped on said river at or near Saint Joseph, Missouri; that the sum of forty-five thousand dollars, or so much thereof as may be necessary, shall be expended on said river at or near Arrow Rock, Missouri; that the sum of seventy-five thousand dollars, or so much thereof as may be necessary, shall be expended on said river at or near Leavenworth, Kansas; that the sum of seventy-five thousand dollars, or so much thereof as may be necessary, shall be expended on said river at or near Atchison, Kansas; and that the sum of twenty-five thousand dollars, or so much thereof as may be necessary, shall be expended on said river at or near Miami, Missouri.

Improving Mokelumne River, California: Removing obstructions, two thousand dollars.

Improving Sacramento and Feather Rivers, California: Continuing improvement, twenty thousand dollars; to be expended for snagging and dredging operations.

Improving Napa River, California, seven thousand five hundred dollars.

Improving San Joaquin River, California: Continuing improvement, twenty-five thousand dollars; a portion of which may be used, in the discretion of the engineer, in closing Laird's Slough and in making the partial closure of what is called "Paradise Cut."

Improving Petaluma Creek, California: Continuing improvement, two thousand dollars.

Improving canal at the Cascades, Oregon: Continuing improvement, three hundred thousand dollars.

Improving Upper Columbia River, including Snake River, Oregon and Washington Territory: Continuing improvement, ten thousand dollars.

Improving the mouth of the Columbia River, Oregon: Continuing improvement, five hundred thousand dollars.

Improving Lower Willamette and Columbia Rivers in front of and below Portland, Oregon: Continuing improvement, one hundred thousand dollars, of which sum one thousand dollars or so much thereof as may be necessary, may be expended in dredging the bar at Skamokawa, on the Columbia River.

Improving Willamette River above Portland, Oregon: Continuing improvement, twenty-nine thousand dollars, of which sum fourteen thousand dollars, if deemed necessary by the Secretary of War, may be expended in revetting the Willamette River, above Corvallis, to prevent the threatened change in the channel of the river at said point.

Improving Coquille River, Oregon: Continuing improvement, twenty-five thousand dollars; of which five thousand dollars is authorized to be expended for snagging between Coquille City and Myrtle Point.

Improving Umpqua River, Oregon: To complete, two thousand dollars.

Gauging waters of the Columbia River, Oregon: For fiscal years ending June thirtieth, eighteen hundred and eighty-eight, and June thirtieth, eighteen hundred and eighty-nine, two thousand five hundred dollars.

Improving Chehalis River, Washington Territory: Continuing improvement, two thousand dollars.

Improving Cowlitz River, Washington Territory: Continuing improvement, three thousand dollars.

Improving Skagit, Stielaquamish, Nootsack, Snohomish and Snoqualmie Rivers, Washington Territory: Continuing improvement, fifteen thousand dollars; of which five thousand shall be used for a snag-boat and outfit.

SEC. 2. That whenever complaint shall be made to the Secretary of War that by reason of the placing in any navigable waters of the United States of any bridge pier or abutment, the current of such waters has been so deflected from its natural course as to cause by producing caving of banks or otherwise serious damage or danger to property, it shall be his duty to make inquiry, and if it shall be ascertained that the complaint is well founded, he shall cause the owners or persons operating such bridge to repair such damage or prevent such danger to property by such means as he shall indicate and within such time as he may name, and in default thereof the owners or persons operating such bridge shall be liable in any court of competent jurisdiction to the persons injured in a sum double the amount of said injury: *Provided, however,* That nothing herein contained shall be construed so as to affect any rights of action which may exist at the time of the passage of this act.

SEC. 3. That it shall be the duty of the Secretary of War to apply the money herein and hereafter appropriated for improvements of rivers and harbors, other than surveys, estimates, and gaugings, in carrying on the various works, by contract or otherwise, as may be most economical and advantageous to the Government. Where said works are done by contract, such contract shall be made after sufficient public advertisement for proposals, in such manner and form as the Secretary of War shall prescribe; and such contracts shall be made with the lowest responsible bidders, accompanied by such securities as the Secretary of War shall require, conditioned for the faithful prosecution and completion of the work according to such contract.

SEC. 4. That for the purpose of securing the uninterrupted examinations and surveys at the South Pass of the Mississippi River, as provided for in the act of March third, eighteen hundred and seventy-five, the Secretary of War, upon the application of the Chief of Engineers, is hereby authorized to draw his warrant or requisition from time to time upon the Secretary of the Treasury for such sums as may be necessary to do such work, not to exceed in the aggregate for each year the amount appropriated in this act for such purpose: *Provided, however*, That an itemized statement of said expenditures shall accompany the Annual Report of the Chief of Engineers.

SEC. 5. That the Secretary of War be, and he is hereby, authorized to make such rules and regulations for the navigation of the South Pass of the Mississippi River as to him shall seem necessary or expedient for the purpose of preventing any obstruction to the channel through said South Pass and any injury to the works therein constructed. The term "South Pass," as herein employed, shall be construed as embracing the entire extent of channel between the upper ends of the works at the head of the pass and the outer or sea end of the jetties at the entrance from the Gulf of Mexico. and any person who shall willfully violate any rule or regulation made by the Secretary of War in pursuance of this act shall be guilty of a misdemeanor, and, on conviction thereof shall pay a fine not exceeding five hundred dollars and undergo an imprisonment not exceeding six months, at the discretion of the court.

SEC. 6. That for the purpose of securing the uninterrupted gauging of the waters of the Lower Mississippi River and its tributaries, as provided for in joint resolution of the twenty-first of February, eighteen hundred and seventy-one, upon the application of the Chief of Engineers, the Secretary of War is hereby authorized to draw his warrant or requisition from time to time upon the Secretary of the Treasury for such sums as may be necessary to do such work, not to exceed in the aggregate for each year the amount appropriated in this act for such purpose: *Provided, however*, That an itemized statement of said expenses shall accompany the annual report of the Chief of Engineers.

SEC. 7. That for the purpose of securing the uninterrupted work of operating snag-boats on the Upper Mississippi River, and of removing snags, wrecks, and other obstructions in the Mississippi River, the Secretary of War, upon the application of the Chief of Engineers, is hereby authorized to draw his warrant or requisition from time to time upon the Secretary of the Treasury for such sums as may be necessary to do such work, not to exceed in the aggregate for each year the amounts appropriated in this act for such purposes: *Provided, however*, That an itemized statement of said expenses shall accompany the annual report of the Chief of Engineers.

SEC. 8. That the Secretary of War shall cause the manuscript of the annual report of the Chief of Engineers and subordinate engineers relating to the improvement of rivers and harbors, and the report of the Mississippi and Missouri River Commissions to be placed in the hands of the Public Printer on or before the fifteenth day of October in each year, and the Public Printer shall cause said reports to be printed with an accurate and comprehensive index thereof, on or before the first Monday in December in each year, for the use of Congress.

SEC. 9. That whenever the Secretary of War shall have good reason to believe that any railroad or other bridge now constructed, or which may hereafter be constructed over any of the navigable water-ways of the United States is an obstruction to the free navigation of such waters, by reason of insufficient height, width of span, or otherwise, or where there is difficulty in passing the draw-opening or the raft-span of such bridge by rafts, steam-boats, or other water-craft, it shall be the duty of the said Secretary to give notice to the persons or corporations owning or controlling such bridge to so alter the same as to render navigation through or under it free, easy, and unobstructed; and in giving such notice he shall prescribe in each case a reasonable time in which such alteration is to be made. If, at the end of such time, the alteration has not been made, the Secretary of War shall forthwith appraise the Attorney-General of the United States, whose duty it shall be to institute suit, in the name of the United States, without delay, in the circuit or district court of the United States for the circuit in which such bridge is located, which court is hereby invested with jurisdiction for this purpose, to recover from the owners or managers of such bridge the fines mentioned in the succeeding sections of this act.

SEC. 10. That the owner or owners or manager or managers of any railroad or other bridge obstructing the free navigation of any navigable water-way of the United States who shall willfully fail or refuse to remove the same, or to cause the necessary alterations to be made in the same so as to render navigation through or under it free, easy, and unobstructed to rafts, steam-boats, or other water-craft, after re-eiving notice to that effect from the Secretary of War and within the time prescribed y him, shall be subject to a fine as penalty therefor of five hundred dollars per month or the time he or they are in default, and the amount so recovered shall be placed to he credit of the improvement fund of the water-way obstructed by such bridge.

SEC. 11. Whenever the improvements provided for by this act, or those which have eretofore been prosecuted by the United States, or may hereafter be undertaken, hall be found to operate (whether by lock and dam or otherwise), as obstructions to he passage of fish, the Secretary of War may, in his discretion, direct and cause to be constructed practical and sufficient fish-ways, to be paid for out of the general ppropriations for the streams on which such fish-ways may be constructed.

SEC. 12. Where it is made manifest to the Secretary of War that the establishment f harbor lines is essential to the preservation and protection of harbors, he may, and s hereby, authorized to cause such lines to be established, beyond which no piers or harves shall be extended or deposits made except under such regulations as may e prescribed from time to time by him.

SEC. 13. That the Secretary of War is hereby directed, at his discretion, to cause xaminations or surveys, or both, to be made, and the cost of improvement to be estinated at the following localities, to wit: In the States of—

ARKANSAS.

Ouachita River, Louisiana and Arkansas, from its mouth to head of navigation, to etermine the advisability and probable cost of its permanent improvement.

ALABAMA.

The Secretary of War is hereby authorized and directed to cause a survey to be ade at the earliest practicable time for the location of a channel in and along the oosa River, in Alabama, from the rapids at Wetumka to connect with the improveents already completed on said river above the Ten Islands, and to direct the engineer aking the survey to report as to the most feasible, economical, and suitable plan or making such improvement.

Warrior River from Tuscaloosa to Demopolis, for deepening and widening the hannel with a view of the easy transportation of coal.

Sipsey River, from the Tombigbee River at Vienna to Texas, with a view of easy ransportation of coal.

Choctawhatchee, for low water navigation.

CALIFORNIA.

San Bennaventure Harbor.

Eel River, entrance and inside bars to head of navigation.

Klamath River, entrance and inside bars to head of navigation.

San Simeon Bay.

The Secretary of War is hereby directed to make an examination and report to ongress as to the necessity for the establishment and maintenance of public moorngs for the protection of shipping in the open and exposed ports on the northern oast of California at Fort Ross, Fish's Mill, Fish Rock, Shelter Cove, Trinidad, and uch other places as may be deemed advisable by him.

CONNECTICUT.

Mystic River.

New London Harbor.

Black Rock Harbor, for breakwater to Pentfield Reef and south from Fairweather sland.

ARIZONA.

Colorado River, between Camp Mojave and El Dorado Canon.

Colorado River, between Camp Mojave and the point where the boundary-line beween Nevada and Utah Territory intersects said river.

DELAWARE.

Nanticoke River, from Seaford to Concord.

Mahon River.

Prime Hook Creek.

Appoquinimink Creek.

DAKOTA.

Ice harbor at or near Bismarck, on the Upper Missouri River.

FLORIDA.

Saint Andrew's Bay.
Chipola River, from its mouth to Marianna.
Saint Mark's River and bar at its mouth.
Ocklawaha River from its mouth to Lake Griffin.
Homosassa River and bar at its mouth.
Chipola River from its mouth to Wewahitchka and the "Cut Off," and "Lee Slough," running from the Apalachicola River to the Chipola River.
Crystal River and bar at its mouth.
Alafia River and bar at its mouth.
Sarasota Bay.
The channel between Tampa Bay and Old Tampa Bay.

GEORGIA.

Flint River, rock reefs at Albany and above.
Savannah River above Augusta and between Augusta and Andersonville.
Oconee River.
Ocmulgee River. Resurvey.

INDIANA.

Grand Calumet River, beginning one-half mile east of Hammond, and thence eastward to Lake Michigan.

For the survey of a canal-way connecting the waters of Lake Michigan with the Calumet River, beginning at a point on the Calumet River one mile east of Hammond, Indiana, and running due north to Berry Lake, and thence along the eastern waters of said Berry Lake; thence northeast to Lake Michigan. The survey to estimate a canal fourteen feet deep and two hundred feet wide.

Berry Lake forming a natural harbor of refuge.

ILLINOIS.

Moline City Harbor.
Grand Calumet River.
Mississippi River, the main slough at Hamilton, Illinois, to the end of securing a good and sufficient steam-boat landing at that point.

IOWA.

For a survey and examination of the Mississippi River at and near the head of Beaver Island, at Clinton, Iowa, to determine what is necessary to remove the sand-bars there formed and forming, so as to make navigable and protect the entrance to the western channel, and the channel itself that runs between Beaver Island and the Iowa shore.

KENTUCKY.

Harbor at Owensboro.
Big Sandy River from Catlettsburgh to Pikeville, on Louisa Fork, and to the mouth of Pond Creek on Tug Fork.

LOUISIANA.

Bayou Teche, from mouth to Saint Martinsville.
Atchafalaya River, from Berwick's Bay to Gulf of Mexico, to secure a channel of twenty feet depth.
Mouth and Passes of Calcasieu River.
Bayou Terrebonne, for continuing dredging three miles above Houma.
Harbor of Baton Rouge.
Tangipahoa River.
Bayou Dorcheat, from Lake Bisteneau to the Arkansas line.
Tchefuncta and Bogue Falia.
Bayou Chitta.
Bayou des Glaises, with a view to establishing locks.
Bayou Saint John, from head of navigation to Lake Ponchartrain.

Bayou Lafourche, from Donaldsonville to Gulf.
Amite River.
Bayou Manchac.
Bayou Teche, with a view to putting in locks.
Tickfaw River.
Bayou Terrebonne and Bayou Black, with the view of opening a shorter water-way tween Mississippi River and Berwick's Bay, Texas and Mexico.

MARYLAND.

Eastern Branch of Potomac River.
Wicomico River.
North East River.
Manokin River.
Warwick River.
Wetypkin River.
Chester River, between Crumpton and Jones' Landing.
South East River.
La Trappe River.
Still Pond Harbor.
Tuckahoe River.
Sassafras River.
Elk River.

MASSACHUSETTS.

Taunton River.
Cohasset Harbor.
Weymouth River.
Goose Point Channel, Plymouth Harbor, to public wharf at Kingston.
Weir River.
Salem Harbor, including South River.
Beverly Harbor.
Cranes and Waters Rivers of Essex Branch.
Martha's Vineyard, inner and outer harbor at Edgarton.
Stage Harbor at Chatham.
Westport Harbor, and East and West Branch of Westport River.
Malden River, as to straightening, widening, and deepening the channel.

MISSISSIPPI.

Gulf Port Harbor, with a view to obtaining a twenty foot channel two hundred feet ide to approach the shore as near as practicable.
Leaf River, from its mouth to mouth of Bowie Creek, near the New Orleans and ortheastern Railroad.
Chickasahay River, from its mouth to Enterprise.
Bluff Creek, from its mouth to the head of navigation.
Tombigbee, between Vienna and Cotton Gin, with a view of obtaining continuous vigation.
Bogue Phalia, especially the part known as the Narrows, with view to its improve-ent.

MINNESOTA.

Duluth.

MICHIGAN.

False Presque Isle Harbor, Lake Huron, for a harbor of refuge.
Au Gres River, to deepen channel to village of Au Gres to ten feet in depth.
Black River, Lake Superior, to deepen channel to depth of sixteen feet and con-ructing a breakwater.
Detroit River, at Gross Point, to dredge channel now in use to depth of twenty et.
Petoskey Harbor, for breakwater and harbor of refuge.
Thunder Bay River, Alpena, for sixteen foot channel from mouth to one mile ove.
Au Sable River at Au Sable, with view of twelve foot channel and breakwater.
Port Austin, for breakwater.
Lexington, for breakwater.
Forestville, for breakwater.

Black River, at Port Huron, to deepen channel from mouth to Grand Trunk railroad bridge to depht of eighteen feet.

Pine River, at Saint Clair City, to deepen channel from mouth to Belknap's brickyard to depth of sixteen feet.

Quanicassee River, to deepen channel from mouth to village of Sebewaing to twelve feet.

Port Sanilac, for harbor of refuge.

Saugatuck Harbor, to obtain channel of navigable width, with a minimum depth of fifteen feet and reconstructing piers.

Monroe Harbor, to deepen channel to sixteen feet.

Grand River, from Grand Rapids to Lake Michigan: For channel of navigable width, minimum depth of ten feet.

Algonac on St. Clair River, with view of uniting north and south channels between Clark and Harsems Islands.

MAINE.

Monhegan Island Harbor.

Belfast Harbor.

Harbor and channel at Pembroke.

Union River and Union River Bay.

Harrissecket River.

Saint Croix River: Resurvey.

Medomac River.

Pleasant River, from Columbia Falls to its mouth.

Kennebunk River.

MISSOURI.

Clarksville Harbor.

Saint Louis Harbor.

Grand River.

The Secretary of War is hereby authorized and directed to cause a survey to be made of the Osage River, Missouri, from its mouth up to the first shoal, and five miles above the same, and to report an estimate, based on such survey, of the cost of constructing one lock and dam within the limits of said survey, and the effect upon the navigation of said river, of constructing said lock and dam.

Missouri River at Miami.

NEW HAMPSHIRE.

Cocheco River, from Dover to its mouth.

The Secretary of War is hereby authorized and directed to cause a survey to be made of the Hampton River in New Hampshire, and to direct the engineer making the survey to report as to the most feasible, economical, and suitable plan for improving the same.

NEW MEXICO.

Rio Grande River, from Embudo to El Paso, Texas.

NEW YORK.

Water-way around Niagara Falls, of capacity and facilities sufficient to float merchant ships and ships of war of modern build, drawing twenty feet of water, said water-way to commence in a navigable part of Niagara River, in Niagara County, at or near Tonawanda, and to end in the navigable waters of said river below said falls or in navigable waters connected therewith. For the purposes hereof the Secretary of War, in his discretion, may take into consideration and revise the surveys and estimates of such a water-way heretofore made by Brevet Colonel C. E. Blunt, of the United States Corps of Engineers, in compliance with a joint resolution of the Congress approved March twenty-second, eighteen hundred and sixty-seven.

Plattsburgh: For extension of three hundred feet on north end of the breakwat

Fort Pond Harbor, Montauk.

East Rockaway Creek, Long Island.

Brown's Creek, Saysville.

Port Jefferson Inlet.

Wappinger's Creek, from Wappinger's Falls to its mouth.

Tarrytown Harbor.

East Rockaway Creek.

Salmon River, from railroad bridge at Fort Covington to the international li with a view of deepening the channel to seven feet.

Black River from Brownville to Lake Ontario.

Cape Vincent Harbor, to establish a breakwater.

Shoals between the Sister Islands and the cross-over light in Saint Lawrence.

Larchmont Harbor.

A ship channel between Jersey City and Ellis Island.

Harbor of refuge at Frontberg, on the south shore of Lake Ontario.

Genessee River, from a point south of the present harbor and above the village of Charlotte, extending southerly a distance about three thousand feet.

Channel connecting Irondequoit Bay with Lake Ontario, for harbor of refuge at Irondequoit Bay.

Harbor at Troutberg.

Harbor, mouth of Salmon River, Lake Ontario.

Lake George, with view of placing buoys and improving channel.

The East River, with the view to the removal of a ledge of rocks in the same, from the foot of Broome street to the foot of Twenty-third street in New York City. This survey to be made notwithstanding any other survey heretofore made.

NEW JERSEY.

Alloway Creek.

Little Salem Creek.

Hackensack River, from the lower bridge at the town of Hackensack to the Erie Railway Bridge.

From the pier Lithe to the main channel, a distance of about sixteen hundred and fifty feet, and seven hundred feet north by northeast from Ellis Island for a ship channel or basin between the deep water of Hudson River and Ellis Island.

NORTH CAROLINA.

Trent River, to upper Quaker bridge.

Fishing Creek.

Shallotte River.

Swift Creek.

White Oak River

North East River (Cape Fear).

Waterway, between New River and Swansboro.

Mackey's Creek.

Pasquotank River, above the mouth of Turner's Cut.

Cape Fear River, North Carolina, from Wilmington to the ocean, with an estimate of the cost of its improvement, with a navigable channel twenty feet deep at mean low water.

Ocracoke Inlet.

Tar River, from Tarboro to Rocky Mount.

OHIO.

Conneaut Harbor, for deepening and widening channel.

Cowles Creek or Geneva.

Mouth of Chagrin River, near Willoughby.

Muskingum River, from Zanesville to Dresden.

OREGON.

Siuslaw River and bar.

Clackamas River.

Tualatin River.

The Secretary of War is authorized and directed to appoint a board of three engineers from the United States Army whose duty it shall be to thoroughly examine the obstructions to navigation in the Columbia River at The Dalles and Celilo Falls, and at Three and Ten Mile Rapids, and to report to the Secretary of War, on or before the first Monday in December next, as to the feasibility and advisability of overcoming such obstructions by means of a boat-railway at The Dalles and Celilo Falls, and by widening, to a navigable status for large tonnage river boats, the channel of said river at Three and Ten Mile Rapids, accompanied by careful and detailed plans, with estimates of the cost and a statement as to the usefulness of such improvements to navigation and of their relations and value to commerce; and said board shall also report, at the same time, as to any other plan or project for overcoming said obstructions at said points, whereby said obstructions to navigation may be removed, which in the judgment of said board may be deemed either more desirable than the above or worthy of consideration by the Secretary of War and Congress, and shall report detailed plans, with estimates of the cost of such proposed improvement or improvements, and as to their relations to commerce and usefulness to navigation; and said board shall report which of said projects is by it deemed most advisable. And the Secretary of War shall transmit said report to Congress, at its next session, with his own views and those of the Chief of Engineers of the United States Army thereon: and the sum of fifteen thousand dollars, or so much thereof as may be necessary, is hereby appropriated to defray the cost of making said examination and survey and the expenses of said board.

Nehalem Bay and bar.

Young's River and its tributary Klaskuine River.

Umpqua River, in the State of Oregon; separate surveys and estimates to be made, first, of that portion of such river between Scottsburgh and the mouth; and second of that portion between Scottsburg and Hart's Rapids, near Elkton.

SOUTH CAROLINA.

Broad and Saluda River, above Columbia.

Beaufort River, from a point three miles south of the town of Beaufort through Coosaw River, with view to its improvement, especially at Brickyard.

Ashepoo River, from the Charleston and Savannah Railroad bridge, six miles down the river, with view to removing obstructions and shoals caused by sunken vessels.

Connect North Edisto and South Edisto Rivers by Saint Pierre River and South Creek.

Savannah River, as to whether the damage to the Vernezobie Freshet Bank in eighteen hundred and eighty-seven was caused by the work at cross-tides, and whether the maintenance of said bank is essential to the success of the work at cross-tides, and what will be the cost of so constructing said bank as to confine the water of said river to its bed.

Owendaw and Wando Rivers and other waters and water-routes connecting Bull's Bay and the harbor of Charleston.

Socastee Creek from its entrance into Waccamaw River to the bridge at Socastee.

Combahee River: Examine whether the breaking of Bull River into Combahee River near the head of Bull River will injure the navigation of Combahee River, and report a plan for obstructing said breaks and the cost thereof.

TEXAS.

For removal of raft on Guadaloupe River.

Mouth of Caney Creek, where it empties in Matagorda Bay.

Removal of bar at mouth of Cedar Bayou where it empties into Galveston Bay.

TENNESSEE.

Lower Cumberland River, from Nashville to mouth, to ascertain if necessary to establish locks and dams.

RHODE ISLAND.

Fishing Place Cove, near Seaconnet Point, with view to constructing a breakwater.

Cove near southeast extremity of Coaster's Harbor Island, and water-way between said island and Rhode Island, with a view to deepening the water-way and removing obstructions.

Entrance to Point Judith Pond, west of Point Judith, with a view of establishing harbor of refuge.

Coast near life-saving station, East Point Judith, with a view to constructing breakwater.

Greenwich Bay, to deepen water on the bar at Long Point.

For a survey of Narragansett Bay at the mouth of Narrow River with a view of constructing a breakwater.

VERMONT.

Swanton Harbor, as to what changes are necessary in present improvements.

VIRGINIA.

Quantico Creek.

Occoquan Creek.

Acquia Creek.

Chickahominy Creek.
Onancock Harbor.
Hampton Creek and Bar.
For cutting of Hospital Point and giving a depth of twenty-five feet and an additional width of two hundred feet.
Chuckatuck Creek.
Bennett's Creek.
Ware River.
Hull Creek.
Occobannock.
Roanoke River, between Clarksville and Eaton Falls.
Hunting Creek, at its mouth.
Harbor of Cape Charles City and approaches by Cheuton Inlet.
Chincoteague Inlet, for purposes of a breakwater.
Machodac River.
Nassowaddox River.
The channel crossing the Potomac from Alexandria, Virginia, to the Maryland side.

NEW YORK.

Great Chazy River from its mouth on Lake Champlain to Champlain Village.

WEST VIRGINIA.

Cheat River.
Monongahela River above upper dam.
Great Cacapan.
South Branch of the Potomac River.

WASHINGTON TERRITORY.

Upper Columbia River, between Wallula and British line.
North Palouse River.

WISCONSIN.

Centreville Creek, Manitowoc County.
Racine Harbor, enlarging and deepening channel.
Kenosha Harbor, for refuge.
Harbor at mouth of Fond du Lac River, in Lake Winnebago.
Oconto Harbor, channel sixteen feet deep and seventy-five feet wide from piers to first contour in river at Spies Slough.

For a survey of Minnesota Point, at Superior, at the west end of Lake Superior, to ascertain what, if anything, should be done to preserve the same from the inroads of the Lake, and for the protection of the harbor, together with the cost thereof.

Menomonee Harbor, from the waters of Green Bay to N. Ludington and Company's mill, Wisconsin, for a channel sixteen feet deep and two hundred feet wide.

SEC. 14. For examinations, surveys, and contingencies, and for incidental repairs, for which there is no special appropriation, for rivers and harbors, one hundred and fifty thousand dollars: *Provided*, That no survey shall be made of any harbors or rivers until the Chief of Engineers shall have directed a preliminary examination of the same by the local engineer in charge of the district, or an engineer detailed for the purpose; and such local or detailed engineer shall report to said Chief of Engineers, whether, in his opinion, said harbor or river is worthy of improvement, and shall state in such report fully and particularly the facts and reasons on which he bases such opinion, including the present and prospective demands of commerce; and it shall be the duty of the Chief of Engineers to direct the making of such survey, if, in his opinion, the harbor or river proposed to be surveyed be worthy of improvement by the General Government; and he shall report to the Secretary of War the facts, and what public necessity or convenience may be subserved thereby, together with the full reports of the local engineer: *And provided further*, That the Government shall not be deemed to have entered upon any project for the construction or improvement of any waterway, harbor or canal mentioned in this act unless or until the work of construction shall have been actually appropriated for. Said reports of preliminary examinations and surveys shall be made to the House of Representatives, and are hereby ordered to be printed when so made.

Received by the President July 31, 1888.

[NOTE BY THE DEPARTMENT OF STATE.—The foregoing act having been presented to the President of the United States for his approval, and not having been returned by him to the house of Congress in which it originated within the time prescribed by the Constitution of the United States, has become a law without his approval.]

AN ACT to authorize the Kentucky Rock Gas Company to lay conduit pipes across the Ohio and Salt Rivers.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the assent of Congress is hereby given to the Kentucky Rock Gas Company to lay pipes for conducting natural gas, petroleum, or salt water across the Ohio River and Salt River, at such points as may be deemed necessary, between the lower boundary of Bradenburgh, in Meade County, Kentucky, and the upper boundary of Louisville, in Jefferson County, Kentucky: *Provided,* That said pipes be laid upon or beneath the bed of the river and in such manner as not to interfere with navigation, and under the supervision of the Secretary of War.

Approved, August 13, 1888.

AN ACT to authorize the Winona and Southwestern Railway Company to build a bridge across the Mississippi River at Winona, Minnesota.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Winona and Southwestern Railway Company, a corporation duly created and existing under the laws of the State of Minnesota, its successors or assigns, be, and they are hereby, authorized to construct and maintain a bridge, and approaches thereto over the Mississippi River, from any point within the present city limits of the city of Winona, in the State of Minnesota, to the opposite shore of said river, in the State of Wisconsin. Said bridge shall be constructed to provide for the passage of railway trains, and at the option of said corporation, its successors and assigns may be so constructed, to provide for and be used also for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers, for such reasonable rates or tolls, to be fixed by said company, its successors or assigns; and the Secretary of War shall have the right, from time to time, to revise, prescribe, and determine such rates of toll.

SEC. 2. That any bridge built under the provisions of this act may, at the option of the company building the same, be built as a draw-bridge or with unbroken continuous spans: *Provided,* That if said bridge shall be constructed as a draw-bridge, the same shall be constructed as a pivot draw-bridge, with a draw over the main channel of the river at an accessible and navigable point, and with spans giving a clear width of water-way of not less than two hundred feet on each side of the central or pivot-pier of the draw, and the next adjoining span or spans to the draw shall give a clear width of water-way of not less than three hundred and fifty feet; and every part of the superstructure shall give a clear headroom of not less than ten feet above extreme high water-mark: *Provided,* That all spans shall be so located as to afford the greatest possible accommodation to the river traffic, and a draw shall, if practicable, be located next or near shore: *Provided also,* That in case of a low bridge if the physical characteristics of the locality so require and the interests of navigation be not injured thereby, the length of the fixed spans or the number of draw openings may be reduced: *Provided also,* That for any two adjacent draw-openings of two hundred feet each, one draw-opening of three hundred feet may be substituted if the interests of navigation be not injured thereby; and not less than ten feet above extreme high water mark, and the piers of said bridge shall be parallel with the current of the river where said bridge shall be erected: *And provided also,* That said draw shall be opened promptly upon reasonable signal for the passage of boats, except when trains are passing over the draw, but in no case shall unnecessary delay occur in opening the said draw during or after the passage of trains: *And provided further,* That if any bridge built under the provisions of this act shall be constructed with unbroken continuous spans, it shall have one or more channel spans, each having not less than three hundred and fifty feet clear channel-way, and not less than fifty-five feet clear head room above high water mark, and the clear head room under other than channel spans may be less than fifty-five feet: *Provided,* That no part of the superstructure of such spans shall give a less head room than ten feet above high water mark: *And provided further,* That the interests of navigation be not injured by such reduction in height; and the piers of said bridge shall be parallel with the current of the said river, and the main span shall be over the main channel of said river, and give a clear width of water-way of not less than three hundred and fifty feet.

SEC. 3. That the company constructing a bridge under the provisions of this act be, and they are hereby, authorized to lay on or over said bridge a railroad track or tracks for the more perfect connection of any railroad or railroads that are or shall be constructed to said river on either or both sides thereof, at or opposite the point of location of said bridge, under the limitations and conditions herein: *Provided*, That said bridge shall not interfere with the free navigation of said river, beyond what is necessary in order to carry into effect the rights and privileges hereby granted; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said river, the cause may be tried before the circuit court of the United States in and for any district in which any portion of said bridge or obstruction touches.

SEC. 4. That any bridge constructed under this act, and according to its limitations, shall be a lawful structure, and shall be known as a post route, and the same is hereby declared to be a post-route, upon which also no higher charges shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States, or for passengers or freight passing over said bridge, than the rate per mile paid for transportation over the railroads and public highways leading to said bridge; and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way for postal-telegraph purposes across said bridge.

SEC. 5. That all railways desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in the use of the machinery and fixtures thereof, and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties in case they shall not agree.

SEC. 6. That the structure herein authorized shall be built and located under and subject to such regulations for the security of the navigation of said river as the Secretary of War shall prescribe; and to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge and map of the location, giving, for the space of one mile above and one mile below the proposed location, the topography of the banks of the river, the shore lines at high and low water, the direction and strength of the current at all stages, and the soundings, accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as shall be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are decided by the Secretary of War to be such as will not materially affect the interests of navigation, the bridge shall not be commenced or built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War; and the said bridge shall be constructed with such aids to the passage of said bridge, in the form of booms, dikes, piers, or other suitable and proper structures for confining the flow of water to a permanent channel, and for the guiding of rafts, steam-boats and other water craft safely through the draw and raft spans, as the Secretary of War shall prescribe and order to be constructed and maintained at the expense of the company owning said bridge; and the said structure shall be at all times so kept and managed as to offer reasonable and proper means for the passage of vessels through or under said structure; and for the safety of vessels passing at night there shall be displayed on said bridge, from the hours of sunset to sunrise, such lights as may be prescribed by the Light House Board; and the said structure shall be changed, or removed at the cost and expense of the owners thereof, from time to time, as the Secretary of War may direct, so as to preserve the free and convenient navigation of said river; and the authority to erect and continue said bridge shall be subject to revocation and modification by law when the public good shall, in the judgment of Congress, or the Secretary of War, so require, without any expense or charge to the United States.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within two years and completed within four years from the date thereof.

SEC. 8. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, August 13, 1888.

AN ACT for improving the mouth of the Brazos River, Texas.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Brazos River Channel and Dock Company, a corporation organized under and by virtue of the laws of the State of Texas, be, and are hereby authorized, on the conditions hereinafter mentioned, to construct, own, and operate such permanent and sufficient jetties and such auxiliary works as are necessary to create and permanently maintain, as hereinafter set forth, a navigable channel at the mouth of the Brazos River, Texas, between said river and the Gulf of Mexico, and so far into the main-land and between the banks of the said Brazos River as may be necessary to reach a place that will afford security from storms, swells, cyclones, and tidal waves, for the purposes of furnishing the vessels and boats adapted to the purpose facilities for navigation in and along the entire length of said channel, charging and collecting such toll therefor as may be prescribed by the regulations that may be made by the Secretary of the Treasury of the United States in conformity with the laws of the United States; and for that purpose they may construct, in the river, and likewise in the Gulf of Mexico, such walls, jetties, dikes, levees, and other structures, and employ such boats, rafts, and appliances as they may, in the prosecution of said work, deem necessary: *Provided*, That no such structures or means employed shall hinder. delay, or materially interfere with the free navigation in said river or between said river and the Gulf of Mexico; and to protect their said works, they may build and maintain such levees or embankments as may be necessary to secure their permanency along the banks of said Brazos River; and said Brazos River Channel and Dock Company shall hold the United States harmless from any damages that may accrue to any person or persons by overflow or otherwise caused by the construction of said walls, jetties, dikes, levees, and other works constructed by said company: *Provided further*, That unless the construction of the proposed work shall be substantially commenced within one year from date of the approval of this act, and prosecuted with due diligence, the provisions contained herein in relation to the said improvement shall be null and void; and unless the said Brazos River Channel and Dock Company shall secure a navigable depth of twelve feet of water from a point in the river so far as may be necessary to reach a place that will afford security from storms, swells, cyclones, and tidal waves, above its mouth and extending from said point to a depth of twelve feet in the Gulf of Mexico, outside of the present bar, within three years after the date of the approval of this act, Congress may revoke the privileges herein granted in relation to said improvement. And Congress may revoke the provisions herein granted in relation to said improvement, unless the said Brazos River Channel and Dock Company shall, after securing twelve feet of water, secure an additional depth of not less than two feet during each succeeding year thereafter; until eighteen feet shall have been secured; and in case said Brazos River Channel and Dock Company shall fail to comply with the foregoing conditions as to depth of water, and time, for any period of twelve months in excess of the time fixed, as aforesaid, then the privileges herein granted, in relation to said improvements shall absolutely become null and void without action by Congress.

SEC. 2. That the works of improvement in the said Brazos River, from the mouth of said river to the point described in section one of this act, shall consist of the construction of dikes, wing-dams, levees, embankments, and dredging or other means which may be considered by said Brazos River Channel and Dock Company necessary for obtaining a depth of eighteen feet of water between the mouth of said river and said point described in section one of this act; and that the said Brazos River Channel and Dock Company may, if they shall decide it best for the interests of navigation, change the course of said river at the sharp bend in said river between the mouth of said river and the said point described in section one of this act, but in making such change the channel shall be made of sufficient depth and width to receive the volume of said river without disturbance of its regimen.

SEC. 3. That if at any time during the construction of said jetties and auxiliary works, or after said jetties and auxiliary works shall have been completed, and said channel of eighteen feet in depth has been obtained, the United States shall have the right to pay the said Brazos River Channel and Dock Company the value of their jetties and other works constructed under and by the authority granted to said company by the State of Texas as well as by the authority of this act, and on such payment being made by the United States all right to said franchises and works on the part of said Brazos River Channel and Dock Company shall cease.

SEC. 4. That Congress may at any time alter, amend or repeal this act.

Received by the President August 9, 1888.

[NOTE BY THE DEPARTMENT OF STATE.—The foregoing act having been presented to the President of the United States for his approval, and not having been returned by him to the house of Congress in which it originated within the time prescribed by the Constitution of the United States, has become a law without his approval.]

AN ACT to authorize the construction and operation of a street-railway and wagon bridge across the Rio Grande, between the city of El Paso, Texas, and Paso del Norte, Mexico.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the consent of Congress is hereby given to the Santa Fe Street Railway Company, a corporation organized and created under and by virtue of the laws of the State of Texas, to construct, own, maintain and operate a street-railway and wagon bridge across the Rio Grande, between the city of El Paso, in the State of Texas, and Paso del Norte, State of Chihuahau, Mexico, at such point as may be most convenient to said corporation to unite and connect a street railway to be constructed by it in the said city of El Paso with any street railway that may be constructed by any person, persons or company in said Paso del Norte; and to build and lay on and across said bridge ways for the passage of animals, foot-passengers, and vehicles of all kinds, and for the transit of freight, goods, wares and merchandise, for which said corporation may charge a reasonable toll, which charge shall be subject to revision and regulation from time to time by the Secretary of War.

SEC. 2. That said bridge shall be built of good, substantial material, and of such strength and dimensions as may be sufficient to render the passage of all such vehicles, animals and persons as are herein mentioned perfectly safe at any and all times.

SEC. 3. That said bridge shall not interfere with the free navigation of said river, and in case of any litigation arising from an obstruction or an alleged obstruction to the free navigation thereof, caused or alleged to be caused by said bridge, the case may be tried before the circuit or district court of the United States for the State in which any portion of said bridge may be situated.

SEC. 4. That equal privileges in the use of said bridge shall be granted to all telegraph companies, and the United States reserves the right for the establishment of a postal telegraph across said bridge.

SEC. 5. That the consent of the State of Chihuahua, United States of Mexico, and of the proper authorities of the Republic of Mexico shall have been obtained before said bridge shall be built or commenced.

SEC. 6. That unless the construction of said bridge be commenced within one year and finished within three years from the date of the passage of this act, the provisions of this act shall be null and void.

SEC. 7. That Congress reserves the right to withdraw the authority and power conferred by this act, in case the free navigation of said river shall at any time be substantially or materially obstructed by said bridge, or for any other reason, and to direct the removal or necessary modifications thereof at the cost and expense of the owners of said bridge; and Congress may at any time alter, repeal, or amend this act.

Approved, September 6, 1888.

AN ACT declaring that certain water reserve lands in the State of Wisconsin are and have been subject to the provisions of the act of Congress entitled "An act granting to railroads the right of way through the public lands of the United States," approved March third, eighteen hundred and seventy-five.

Be it enacted by the Senate and House of Representatives of the United States of America n Congress assembled, That all lands in the State of Wisconsin described in and withdrawn from sale by the proclamations of the President of the United States issued March twenty-second, eighteen hundred and eighty, April fifth, eighteen hundred and eighty-one, and November twenty-eighth, eighteen hundred and eighty-one, for he reason that said lands would be required for or subject to flowage in the construction of dams, reservoirs, and other works proposed to be erected for the improvement of the navigation of the Mississippi River and certain of its tributaries, be, and the same are hereby, declared to be, and to have been at all times heretofore, subject to the provisions of a certain act of Congress, entitled "An act granting o railroads the right of way through the public lands of the United States," approved March third, eighteen hundred and seventy-five, as fully, effectually, and to he same extent as though said lands had not been described in said proclamations, or withdrawn from sale thereby, but had remained with the body of public lands subject to private entry and sale: *Provided, however*, That any and all parts of said ands acquired by any railroad company under said act of Congress shall at all times be subject to the right of flowage which at any time may become necessary in the construction or maintenance of dams, reservoirs, or other works which may be constructed or erected by or under the authority of the United States for the improvement of the navigation of the Mississippi River or its tributaries: *Provided further*, That the railroad companies availing themselves of this act shall, in addition to filing he maps now required by law to be filed, also file maps of definite location of their proposed lines of railroad, over said water reserve lands, in the office of the Secretary of War, and until the approval of said maps by the Secretary of War no right to occupy said lands shall vest in such companies; and no location shall be permitted which takes for right of way or stations lands needed for the use of the present reservoir system, or in the construction of dams or other works, or any proposed or probable extension of the same, or which will obstruct or increase the cost of the present or prospective reservoir system; or shall any railroad company be permitted to take material for construction from any of said reservoir lands outside the right of way granted herein.

Approved, September 10, 1888.

AN ACT amendatory of an act authorizing the construction of a bridge over the Mississippi River at Saint Louis, Missouri, approved February third, eighteen hundred and eighty-seven.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section eleven of the act entitled "An act authorizing the construction of a bridge over the Mississippi River at Saint Louis, Missouri," approved February third, eighteen hundred and eighty-seven, be, and the same is hereby, amended by striking out the words "stockholder or" wherever they occur in said section, so as to make said section read as follows:

"SEC. 11. That whereas a principal reason for giving authority to build the bridge herein contemplated is to secure reasonable rates and tolls for corporations and individuals for passing over the same, the Saint Louis Merchants' Bridge Company, or its successors or assigns, shall not agree or consent to the consolidation of this bridge company with any other bridge company across the Mississippi River, or to the pooling of the earnings of this bridge company with the earnings of any other bridge company on said river, nor shall any person who is or may be a director or manager of any other bridge over said river be a director or manager of the bridge herein provided for: *Provided,* That if this provision of this act shall at any time be violated in any of these particulars, such violation shall, without legal proceeding, at once forfeit the privilege hereby granted, and said bridge shall become the property of the United States, and the Secretary of War shall take possession of the same in the name and for the use of the United States."

SEC. 2. The right to amend or repeal this act is hereby expressly reserved.

Approved, September 10, 1888.

AN ACT making appropriations for the support of the Army for the fiscal year ending June thirtieth eighteen hundred and eighty-nine, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and they are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, for the support of the Army for the year ending June thirtieth, eighteen hundred and eighty-nine:

* * * * * * *

ENGINEER DEPARTMENT.

Engineer depot at Willet's Point, New York: Incidental expenses of the depot, fuel, chemicals, stationery, extra-duty pay for soldiers employed in wheelwright's work, engine-driving, draughting, printing, photographing, and lithographing engineer documents, repairs of public buildings, and unforeseen expenses, five thousand dollars; for purchase of materials for the instruction of engineer troops at Willets' Point in their special duties of sappers, miners, for land and submarine mines, and pontoneers, torpedo drill and signaling, one thousand five hundred dollars; for purchase and repairs of instruments to be issued to officers of the Corps of Engineers, for use on public works and surveys, two thousand dollars; to replace the building known as the laboratory for enlisted men, which was destroyed by fire in November, eighteen hundred and eighty-six, six thousand five hundred dollars; library of the Engineer School of Application: purchase and binding of professional works of recent date treating of military and civil engineering, five hundred dollars; in all, fifteen thousand five hundred dollars.

For repairs to sea-wall and wharf at Willetts' Point, New York, two thousand five hundred dollars.

* * * * * * *

Approved September 22, 1888.

AN ACT making appropriations for fortifications and other works of defense, for the armament thereof, for the procurement of heavy ordnance for trial and service, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the appropriations hereinafter provided for shall be available until expended and shall be expended under the direct supervision of a board to consist of the commanding General of the Army, an officer of Engineers, an officer of Ordnance, and an officer of Artillery, to be selected by the Secretary of War, to be called and known as the Board of Ordnance and Fortification; and said Board shall be under the direction of the Secretary of War and subject to his supervision and control in all respects, and shall have power to provide suitable regulations for the inspection of guns and materials at all stages of manufacture to the extent necessary to protect fully the interests of the United States, and generally to provide such regulations concerning matters within said Board's operations as shall be necessary to carry out to the best advantage all duties committed to its charge: *Provided*, That subject to the foregoing provisions the expenditure shall be made by the several bureaus of the War Department having jurisdiction of the same under existing law.

SEC. 2. That the sums of money herein provided for be, and the same are hereby, appropriated, out of any moneys in the Treasury not otherwise appropriated, namely:

For the protection, preservation, and repair of fortifications and other works of defense, one hundred thousand dollars. For the construction of sea-walls, and for earth embankments, one hundred and seventeen thousand dollars.

For torpedoes for harbor defense; the purchase of submarine mines and necessary appliances to operate them; for needful casemates, cable-galleries, and appliances to render it possible to operate submarine mines; for continuing torpedo experiments; for practical instruction of engineer troops in detail of the service, and for the purchase of movable submarine torpedoes controlled at will by power transmitted from shore stations, two hundred thousand dollars.

SEC. 3. For the completion of the guns now under fabrication by the Ordnance Department and for testing the same, and for the manufacture or purchase and test of cannon and carriages, including carriages manœuvred by power, one of which shall be a disappearing carriage, and also including those for the field and siege services; for the alteration of carriages on hand to adapt them to improved service guns; for projectiles, powders, fuzes, and implements, their trial and proof; for experiments in the means of protecting torpedo lines; for compensation of draughtsmen while employed in the Army Ordnance Bureau on ordnance construction, and for the necessary expenses of ordnance officers while temporarily employed at the proving-ground and absent from their proper stations, at the rate of two dollars and fifty cents per diem while so employed, five hundred thousand dollars, and not more than ten thousand dollars of said sum shall be expended for providing increased facilities for the manufacture of projectiles; for examining, testing, and experimenting with pneumatic or other dynamite guns, gun-carriages, aerial torpedoes, dynamite shells and ammunition, and batteries for coast defense, whether sunken, counterpoise, or otherwise, brought to the notice of said board, one hundred thousand dollars, or so much thereof as may be deemed proper: *Provided*, That all material purchased under this section, excepting samples, shall be of American manufacture.

SEC. 4. For the erection, purchase, or manufacture of the necessary buildings and other structures, machinery, tools, and fixtures for an army gun-factory for finishing and assemblying heavy ordnance, to be erected at the Watervliet Arsenal, West Troy, New York, seven hundred thousand dollars: *Provided*, That not exceeding twenty thousand dollars of this sum may be used for the erection and completion of two sets of officers' quarters.

For the purchase of rough-finished, oil-tempered, and annealed steel for high power coast-defense guns of eight, ten, and twelve inch caliber, in quality and dimensions conforming to specifications, subject to inspection at each stage of the manufacture, and including all the parts of each caliber, one million five hundred thousand dollars: *Provided*, That no money shall be expended except for steel accepted and delivered, and no contract shall be made hereunder for gun steel at a greater average price per pound for each caliber than the lowest average price paid under contracts hitherto made by the Government for American forgings of like caliber.

The material for the guns provided for herein shall be purchased in accordance with section thirty-seven hundred and nine, Revised Statutes, for which purpose the Secretary of War is authorized to make contracts with responsible steel manufacturers, who shall be resident citizens of the United States, after proper advertisement, continuing not less than thirty days in the newspapers most likely to reach the said manufacturers: *Provided*, That each bidder with whom such contracts shall be made, shall have, or agree to erect, in the United States a suitable plant, including the best modern appliances, capable of making all the steel required, and of finishing it in accordance with the contracts, and shall further agree to deliver yearly a specified quantity of each caliber, the time of the delivery of the steel for the smaller calibers of heavy guns to commence at the expiration of not more than eighteen months, and that for the largest calibers, specified in the advertisement, at the expiration of not more than three years from the date of the acceptance of the contracts; and that all the tools, machines, and material for said guns shall be manufactured in the United States.

SEC. 5. For the purchase of the material for, and the manufacture of, twelve inch breech-loading rifled mortars of cast-iron, hooped with steel, of about thirty-two thousand pounds weight, similar to, and equal in range, power, and accuracy of fire to the twelve inch breech-loading mortar, cast-iron, steel-hooped, now at the Ordnance proving-ground, Sandy Hook, New Jersey, said mortars to be subject to inspection in all stages of manufacture, two hundred and fifty thousand dollars.

SEC. 6. Whenever any party shall present for test a completed cast-iron breech-loading mortar of twelve inches caliber, of about thirty-two thousand pounds weight, with a proper supply of ammunition therefor, not exceeding two hundred rounds, such mortar shall be tested in the presence of the party presenting the same, and should it be shown to the satisfaction of the Board by such tests to be equal in accuracy, range, power, endurance, material, and general efficiency to the twelve-inch cast-iron steel-hooped breech-loading mortar now at Sandy Hook, the mortar and ammunition shall be paid for, including cost of transportation, and contract be made for a further supply of not less than fifty, and not more than one hundred, at such reasonable cost as the Board herein provided for shall determine, not to exceed six thousand five hundred dollars each. The entire number to be delivered in one year from date of contract. Said mortar and all which may be contracted for under this provision shall be subject to inspection at each stage of manufacture.

Whenever any party shall present for test a completed single-charge breech-loading steel gun of ten or twelve inches caliber, and of weight and dimensions to be prescribed by the Board with the proper supply of ammunition for the test of the same, such gun shall, in the presence of the party presenting it, be subjected to such tests as the Board shall have prescribed; and should such gun be shown to the satisfaction of the Board by such tests to fullfill the requirements previously prescribed in respect to accuracy, range, power, endurance, and general efficiency, the gun and ammunition shall be paid for at a fair valuation, including cost of transportation, and contract shall be made at a price reasonable in the opinion of the Board, with the party presenting the best of such guns, for a further supply of similar guns, to be subjected to the usual service test before acceptance, the experimental gun and all guns purchased hereunder to be subject to inspection at each stage of manufacture, as follows, namely: For not less than fifty ten-inch steel guns; and for not less than fifty twelve-inch steel guns.

The Board is authorized to make all needful and proper purchases, investigations, experiments, and tests, to ascertain with a view to their utilization by the Government, the most effective guns, including multicharge guns and the conversion of Parrott and other guns on hand, small arms, cartridges, projectiles, fuzes, explosives, torpedoes, armor-plates, and other implements and engines of war; and the Secretary of War is hereby authorized to purchase or cause to be manufactured, such guns, carriages, armor-plates, and other war materials and articles as may, in the judgment of said Board, be necessary in the proper discharge of the duty herein devolved upon them: *Provided*, That the amount expended and liabilities incurred in such purchases, investigations, experiments, and tests shall not exceed five hundred thousand dollars which sum is hereby appropriated: *Provided further*, That said Board shall test, and if found satisfactory, shall purchase two breach loading field guns of three and two tenths inch bore of aluminum bronze.

That under the provisions of this section there shall not be expended or contract or contracts entered into involving the Government in an aggregate expenditure exceeding six million five hundred thousand dollars, nor an expenditure on the part of the Government in any one fiscal year in excess of two million dollars, and all guns and materials purchased under authority of this section shall be of American production and furnished by citizens of the United States.

For payment of the necessary expenses of the Board including a per diem allowance to each member thereof when employed on duty away from his permanent station, of two and one-half dollars a day, five thousand dollars, or so much thereof as may be necessary.

Approved, September 22, 1888.

AN ACT to amend an act entitled "An act making appropriations for the construction, repair and preservation of certain public works on rivers and harbors, and for other purposes," approved July fifth, eighteen hundred and eighty-four.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That section seven of the "Act making appropriations for the construction, repair, and preservation of certain public works on rivers and harbors, and for other purposes," approved July fifth, eighteen hundred and eighty-four be, and the same is hereby, amended, so that the same shall read as follows:

"SEC. 7. That it shall be the duty of the Secretary of War to prescribe such rules and regulations in respect to the use and administration of the Des Moines Rapids Canal, the Saint Mary's Falls Canal, the Louisville and Portland Canal, and the Saint Clair Flats Ship Canal as in his judgment the public necessity may require, which rules and regulations shall be posted in some conspicuous place for the information of the public; any person knowingly and willfully violating such rules and regulations shall be liable to a fine not exceeding five hundred dollars, or imprisonment not exceeding six months, to be enforced in any district court in the United States within whose territorial jurisdiction such offense may have been committed."

SEC. 2. That this act shall take effect immediately.

Approved, September 26, 1888.

AN ACT for the investigation of the mining debris question in the State of California.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War is hereby authorized and directed to detail three officers from the Engineer Corps of the United States Army as a commission for the purpose of making a thorough examination and investigation of the mining debris question in the State of California, for the purpose of ascertaining whether some plan can be devised whereby the present conflict between the mining and farming sections may be adjusted and the mining industry rehabilitated; and for a complete examination of the injured navigable river channels, their tributaries and lands adjacent thereto, with a view to the improvement and rectification of said rivers. And that the sum of ten thousand dollars, or so much thereof as may be necessary, is hereby appropriated, out of any money in the Treasury not otherwise appropriated, for the purpose of carrying into effect the provisions of this act. said sum to be expended at the discretion of the Secretary of War; the said commission to report as early as practicable to the Secretary of War the result of their investigation, and the Secretary of War shall make report thereof to Congress.

Approved, October 1, 1888.

AN ACT to grant the right of way through the military reservation at Fort Morgan to the Birmingham, Mobile and Navy Cove Harbor Railway Company, and for other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That there is hereby granted to the Birmingham, Mobile and Navy Cove Harbor Railway Company the right of way through the military reservation at Fort Morgan, Alabama, for road-bed, tracks, side tracks, and terminal facilities not exceeding fifty feet in width along the northern high-water line of said reservation and extending from the eastern boundary of said reservation westward along the shore to a point one hundred feet east of the east side of the present Government dock at or near which point the said company may erect a wharf after the Secretary of War shall have approved of the location and dimensions thereof, with such sheds and buildings as can be accommodated thereon, and the said company shall also have the right to fill into the water along the right of way so granted, and thus acquire additional space and to enjoy other riparian rights: *Provided, however,* That not buildings or other incumbrances shall be erected on said right of way except upon said wharf; but the Secretary of War may give permission for the erection along said right of way of a dock or docks upon limitations to be prescribed by him: *And provided further,* That Congress may at any time cancel this concession, and the President may, when in his judgment necessity demands, destroy any structures hereby authorized.

Approved, October 1, 1888.

AN ACT making appropriation for sundry civil expenses of the Government for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, and for other purposes.

Be it enacted by the Senate and House of Representatatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated for the objects hereinafter expressed for the fiscal year ending June thirtieth, eighteen hundred and eighty-nine, namely:

---

* * * * * * *

BUILDING FOR THE LIBRARY OF CONGRESS.

For the building for the Library of Congress, as herein provided for, and for each and every purpose connected therewith, including the cost of all professional and other personal services that the Chief of Engineers of the Army may deem necessary for the work and shall specially order five hundred thousand dollars.

This appropriation and all appropriations hereafter made, and all sums available from appropriations heretofore made for this purpose shall be expended under the direction and supervision of the Chief of Engineers of the Army, who shall have the control and management of all of said work and the employment of all persons connected therewith. And all contracts for the construction of said building, or any part thereof, shall be made by the Chief of Engineers of the Army, and so much of the act entitled "An act authorizing the construction of a building for the accommodation of the Congressional Library" approved April fifteenth, eighteen hundred and eighty-six as requires the construction of said building substantially according to the plan submitted to the Joint Select Committee on Additional Accommodations for the Library of Congress, by John L. Smithmeyer and so much of the first section as provides for a commission together with the eighth section of said act be and the same are hereby repealed, and the duties of said commission under said act are hereby devolved upon the Chief of Engineers of the Army, who shall annually report to Congress at the commencement of each session a detailed statement of all the proceedings under the provisions of this act, and hereafter, until otherwise ordered by Congress, no work shall be done in the construction of said Library except such as is herein provided for, and all contracts for work or materials not necessary for the execution of the work contemplated herein are hereby rescinded. And all loss or damage occasioned thereby or arising under said contracts, together with the value of the plan for a Library Building submitted to the Joint Select Committee on Additional Accommodations for the Library of Congress by John L. Smithmeyer in the Italian Renaissance style of Architecture, may be adjusted and determined by the Secretary of the Interior, to be paid out of the sums heretofore or hereby appropriated: *Provided*, That before any further contracts are let for the construction of said building general plans for the entire construction thereof shall be prepared by or under the direction of the Chief of Engineers of the Army, which plans shall be subject to the inspection and approval of the Secretary of War and the Secretary of the Interior: *And provided further*, That the total cost of said building shall not exceed four million dollars exclusive of appropriations heretofore made.

* * * * * * *

UNDER THE WAR DEPARTMENT.

BUILDINGS AND GROUNDS IN AND AROUND WASHINGTON.

For the improvement and care of public grounds as follows:

For improvement and maintenance of grounds south of the Executive Mansion, six thousand dollars.

For ordinary care of greenhouses and nursery, two thousand dollars.

For ordinary care of Lafayette Square, one thousand dollars.

For ordinary care of Franklin Square, one thousand dollars.

For continuing improvement of reservation numbered seventeen, and site of old canal, northwest of same, ten thousand dollars: *Provided*, That no part thereof shall be expended upon other than property belonging to the United States.

For construction and repair of post-and-chain fences, removal and repair of high iron fences around reservations, one thousand five hundred dollars.

For manure, and hauling the same, five thousand dollars.

For painting watchmen's lodges, iron fences, vases, lamps, lamp-posts, and settees, seven hundred and fifty dollars.

For purchase and repair of seats, one thousand dollars.

For purchase and repair of tools, two thousand dollars.

For trees, tree and plant stakes, lime, whitewashing, and stock for nursery, three thousand dollars.

For removing snow and ice, one thousand two hundred dollars.

For flower-pots, twine, baskets, wire, splints, moss, and lycopodium, one thousand dollars.

For care, construction, and repair of fountains in the public grounds, one thousand five hundred dollars.

For abating nuisances, five hundred dollars.

For improvement, care, and maintenance of various reservations, twelve thousand dollars.

For improvement, maintenance and care of Smithsonian Grounds, including construction of asphalt roads and paths, ten thousand dollars.

For improvement and care of Judiciary Square, including grounds around the Pension Building, and asphalt walks leading to City Hall, five thousand dollars.

That under appropriations herein contained no contract shall be made for making or repairing concrete or asphalt pavements in Washington City at a higher price than two dollars per square yard for a quality equal to the best laid in the District of Columbia prior to July first, eighteen hundred and eighty-six, and with a base of not less than six inches in thickness.

For repairs and fuel of the Executive Mansion as follows:

For care, repair, repainting, and refurnishing the Executive Mansion, sixteen thousand dollars to be expended by contract or otherwise, as the President may determine.

For fuel for the Executive Mansion, greenhouses, and stable, three thousand dollars.

For care and necessary repair of greenhouses, four thousand dollars.

For renewing entire superstructure of one greenhouse connected with the Executive Mansion and grounds, one thousand five hundred dollars.

LIGHTING THE EXECUTIVE MANSION AND PUBLIC GROUNDS: For gas, pay of lamplighters, gas-fitters, and laborers; purchase, erection, and repair of lamps and lamp-posts; purchase of matches, and for repairs of all kinds; fuel and lights for office, office-stables, watchmen's lodges, and for the greenhouses at the nursery, fourteen thousand dollars: *Provided*, That for each six-foot burner not connected with a meter in the lamps on the public grounds no more than twenty dollars shall be paid per lamp for gas, including lighting, cleaning, and keeping in repair the lamps, under any expenditure provided for in this act; and said lamps shall burn not less than two thousand six hundred hours per annum; and authority is hereby given to substitute other illuminating material for the same or less price, and to use so much of the sum hereby appropriated as may be necessary for that purpose.

REPAIR OF WATER-PIPES AND FIRE-PLUGS: For repairing and extending water-pipes, purchase of apparatus to clean them, purchase of hose, and cleaning the springs and repairing and renewing the pipes of the same that supply the Capitol, the Executive Mansion, and the building for the State, War, and Navy Departments, two thousand five hundred dollars.

For furnishing a full supply of water for all purposes to the Executive Mansion by connecting the Mansion by a twelve inch main with the thirty-six inch water-main on L street, five thousand three hundred dollars.

TELEGRAPH TO CONNECT THE CAPITOL WITH THE DEPARTMENTS AND GOVERNMENT PRINTING OFFICE: For care and repair of existing lines, one thousand two hundred and fifty dollars.

WASHINGTON MONUMENT: For completion of the Washington Monument, namely: For earth-filling and grading around the monument, in accordance with existing law; insertion of memorial tablets presented for that purpose in the interior walls of the monument; office expenses, and every purpose connected with the completion of the monument, twenty-seven thousand five hundred dollars, to be expended under the direction of the Secretary of War.

For the care and maintenance of the Washington Monument and the operation of the elevator and machinery connected therewith, namely: For one custodian, at one hundred dollars per month; one steam engineer, at eighty dollars per month; one assistant steam engineer, at sixty dollars per month; one fireman, at fifty dollars per month; one assistant fireman, at forty-five dollars per month; one conductor of car, at seventy-five dollars per month; one attendant on floor, at forty-five dollars per month; one attendant on top, at forty-five dollars per month; three night and day watchmen, at sixty dollars each per month; coal, one thousand seven hundred and fifty dollars; oil, waste, packing, and repairs to engine and boiler, five hundred dollars; contingencies, ninety dollars; in all, ten thousand five hundred dollars, to be expended under the direction of the Secretary of War, who is hereby and hereafter charged with the custody, care, and protection of the monument.

And the joint commission created by the act of August second, eighteen hundred and seventy-six, for the completion of the Washington Monument, having completed the work intrusted to it, is, at its own request, dissolved, and the unexpended balances of appropriations for this work, as well as the amount herein appropriated, shall be expended under the direction of the Secretary of War; and the Washington National Monument Society is hereby continued with the same powers as provided in the act of August second, eighteen hundred and seventy-six, creating the joint commission aforesaid; and the Secretary of War is hereby directed to set apart a room for the deposit of the archives of the Washington National Monument Society as also for the records of the joint commission dissolved) and for the continuous use of said society in the building now being erected by the said society with funds collected by it for its use and for the public comfort.

* * * * * * *

MISSISSIPPI RIVER COMMISSION: For salaries and traveling expenses of the Mississippi River Commission, and for salaries and traveling expenses of assistant engineers under them, and for office expenses and contingencies, thirty-five thousand dollars.

* * * * * * *

MONUMENTS OR TABLETS AT GETTYSBURG: That the appropriation of fifteen thousand dollars, made by the act approved March third, eighteen hundred and eighty-seven, for the erection of monuments or memorial tablets for the proper marking of the position of each of the commands of the regular Army engaged at Gettysburg, be, and the same is hereby, made available for the purchase of land upon which to erect the monuments and tablets.

For the completion of the monument at Washington's Headquarters at Newburgh, New York, and of the statues thereon, according to the plans adopted by the joint select committee of the Senate and House of Representatives, under joint resolution of the two Houses, and for gates therein, according to the recommendation of the

Secretary of War, contained in Executive Document Numbered Three hundred and thirty-six, Fiftieth Congress, first session, to be expended under the direction of the Secretary of War, thirty-two thousand dollars

MISCELLANEOUS OBJECTS.

SURVEY OF NORTHERN AND NORTHWESTERN LAKES: For printing and issuing charts for use of navigators, and electrotyping plates for chart-printing, two thousand dollars.

TRANSPORTATION OF REPORTS AND MAPS TO FOREIGN COUNTRIES: For the transportation of reports and maps to foreign countries, through the Smithsonian Institution, one hundred dollars.

* * * * * * *

Approved October 2, 1888.

AN ACT to authorize the construction of bridges across the Kentucky River and its tributaries by the Louisville Southern Railroad Company.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Louisville Southern Railroad Company, a corporation organized under act of the general assembly of the commonwealth of Kentucky, be, and it is hereby, authorized to construct and maintain a bridge, and approaches thereto, over the Kentucky River, in the State of Kentucky, and also a bridge or bridges over the tributaries or forks of said river, at such point or points as said company may deem suitable for the passage of its said road over said river, or its tributaries or forks. Said bridge or bridges shall be constructed to provide for the passage of railway trains, and, at the option of the company by which it or they may be built, may be used for the passage of wagons and vehicles of all kinds, for the transit of animals, and for foot-passengers.

SEC. 2. That any bridge built under this act, and subject to its limitations, shall be a lawful structure, and shall be recognized and known as a post-route, and it shall enjoy the rights and privileges of other post-roads in the United States, and equal privileges in the use of said bridge shall be granted to all telegraph companies; and the United States shall have the right of way across said bridge and its approaches for postal telegraph purposes.

SEC. 3. That any bridge authorized to be constructed under this act shall be built and located under and subject to such regulations for the security of navigation of said river as the Secretary of War shall prescribe; and to secure that object, the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawing of the bridge, and a map of the location thereof; and until the said plan and location of the bridge are approved by the Secretary of War, the bridge shall not be commenced or built; and should any change be made in the plan of said bridge during the progress of construction, such change shall be subject to the approval of the Secretary of War. And any changes required by the Secretary of War, or the entire removal of said bridge or bridges after completion if required by him, shall be at the expense of the company owning said bridge.

SEC. 4. That all railroad companies desiring the use of said bridge or bridges shall have, and be entitled to, equal rights and privileges relative to the passage of railway trains over the same, and over the approaches thereto, upon the payment of reasonable compensation therefor; and in case the owner or owners of said bridge or bridges and the railroad company or companies desiring to use same shall fail to agree upon the terms with reference to the use of same, all matters of issue between them shall be decided by the Secretary of War upon a hearing of the allegations and proofs of the parties. And if said bridge or bridges shall be built for the passage over the same of vehicles, and the transit of animals, and for foot passengers, the rates of toll therefor shall be approved by the Secretary of War, before any tolls can be collected.

SEC. 5. That this act shall be null and void if actual construction of the bridge or bridges herein authorized be not commenced within two years and completed within five years from the date thereof.

SEC. 6. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, October 9, 1888.

AN ACT to authorize the construction of a highway bridge across that part of the waters of Lake Champlain which separates the islands of North Hero and South Hero, in the county of Grand Isle, in the State of Vermont

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the proper authorities of the towns of North Hero and

Grand Isle, in the county of Grand Isle, in the State of Vermont, be, and they are hereby, authorized to construct, maintain, and use a highway bridge at a suitable point across the channel which lies between the islands of North Hero and South Hero and between the two towns aforesaid.

SEC. 2. That the structure authorized by the preceding section shall be built and located under and subject to such regulations for the security of navigation of such waters as the Secretary of War shall prescribe, and shall be provided with such suitable and convenient draw as the said Secretary shall deem needful for the proper purposes of navigation, of width not less than that of the draw in the bridge between the towns of Alburg and North Hero, Vermont; and the maintenance and management of said structure shall be subject to such of the provisions of section six of chapter fifty-two of the acts of the second session of the Forty-seventh Congress as the Secretary of War may, from time to time, deem needful; and the authority to erect and continue said bridge shall be subject to revocation and modification by law whenever the public good shall, in the judgment of the Secretary of War so require, without any expense or charge to the United States.

SEC. 3. That the right to alter, amend, or repeal this act is hereby expressly reserved.

Approved, October 12, 1888.

AN ACT to authorize the construction of a bridge across the Missouri River at some accessible point within one mile north and one mile south and east of the mouth of the Kansas River.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the Missouri River and Land Improvement and Construction Company, a corporation organized under the laws of the State of Kansas, or its assigns, is hereby authorized to construct and maintain a bridge across the Missouri River at such point as may be hereafter selected by said corporation, or its assigns, in Jackson County, Missouri, within one mile north and one mile south and east of the mouth of Kansas River, Kansas; and also to construct accessary works to secure the best practicable channel-way for navigation and confine the flow of the water to a permanent channel at such point; and also to lay on and over said bridge a railway track or tracks for the more perfect connection of any railroads that are or shall be constructed to said Missouri River at or opposite said point; and said corporation may construct and maintain ways for wagons, carriages, horses, or other animals, and for foot passengers, charging and receiving such reasonable toll therefor as may be approved from time to time by the Secretary of War.

SEC. 2. That said bridge shall be constructed and built without interference with the security and convenience of navigation of said Missouri River beyond what is necessary to carry into effect the rights and privileges hereby granted; and in order to secure that object the said company or corporation shall submit to the Secretary of War, for his examination and approval, a design and drawings of the bridge, and a map of the location, giving for the space of one mile above and one mile below the proposed location, the topography of the banks of the Missouri River, the shore lines at high and low water, the direction and strength of the current at all stages, and the soundings accurately showing the bed of the stream, the location of any other bridge or bridges, and shall furnish such other information as may be required for a full and satisfactory understanding of the subject; and until the said plan and location of the bridge are approved by the Secretary of War the bridge shall not be built: *Provided,* If said bridge be built above the mouth of the Kansas River, it shall be built as a high bridge with unbroken and continuous spans, having at least one channel span of not less than four hundred feet clear channel-way, all other spans over the water-way to have a clear channel-way of not less than three hundred feet; and all said spans shall have a clear head room of not less than fifty feet above high-water mark: and if it shall be built below the mouth of the Kansas River, it shall be built as a high bridge with unbroken and continuous spans, all spans over the water way to have a clear channel way of not less than four hundred feet and a clear head room of not less than fifty-five feet above high water mark; and the piers of said bridge shall be parallel with the current of said river, at the stage of water which is most important to navigation, and the bridge itself shall be built as nearly as may be at right angles thereto; and said company or corporation shall maintain, at its own expense, from sunset to sunrise, such lights or other signals on said bridge as the Light-House Board shall prescribe: *Provided also,* That all railway companies desiring to use said bridge shall have and be entitled to equal rights and privileges in the passage of the same, and in the use of the machinery and fixtures thereof and of all the approaches thereto, under and upon such terms and conditions as shall be prescribed by the Secretary of War, upon hearing the allegations and proofs of the parties, in case they shall not agree.

SEC. 3. That the Secretary of War is hereby authorized and directed, upon receiving such plan and map and other information, and upon being satisfied that a bridge built on such plan, and with such accessory works, and at such locality, will conform to the prescribed conditions of this act, to notify the company that he approve the same; and upon receiving such notification the said company may proceed to an erection of said bridge, conforming strictly to the approved plan and location; and should any change be made in the plan of the bridge or said accessory works, during the progress of work thereon, such change shall be subject likewise to the approval of the Secretary of War, and be made at the expense of the company making the same; and in case of any litigation arising from any obstruction or alleged obstruction to the free navigation of said Missouri River, caused or alleged to be caused by said bridge, the case may be brought in the circuit court of the United States for the district of Kansas or for the district of Missouri in which any portion of said obstruction or bridge may be located.

SEC. 4. That the said bridge and accessory works, when built and constructed under this act and according to the terms and limitations thereof, shall be lawful structures; and said bridge shall be recognized and known as a post-route upon which also no higher charge shall be made for the transmission over the same of the mails, the troops, and the munitions of war of the United States than the rate per mile paid for the transportation over the railroad or public highways leading to said bridge; and said bridge shall enjoy the rights and privileges of other post-routes in the United States; and Congress reserves the right at any time to regulate by appropriate legislation the charges of freight and passengers over said bridge.

SEC. 5. That the United States shall have the right of way for such postal-telegraph lines across said bridge as the Government may construct or control, and equal privileges in the use of said bridge shall be granted to all telegraph and telephone companies.

SEC. 6. That Congress shall have power at any time to alter, amend, or repeal this act so as to prevent or remove all obstructions to the navigation of said river by the construction of said bridge and its accessory works; and the expense of altering said bridge or removing such obstructions shall be at the expense of the owners of or persons controlling such bridge.

SEC. 7. That this act shall be null and void if actual construction of the bridge herein authorized be not commenced within one year and completed within three years from the date thereof.

Approved, October 12, 1888.

AN ACT making appropriations to supply deficiencies in the appropriations for the fiscal year ending June thirtieth, eighteen hundred and eighty-eight, and for prior years, and other purposes.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That the following sums be, and the same are hereby, appropriated, out of any money in the Treasury not otherwise appropriated, to supply deficiencies in the appropriations for the fiscal year eighteen hundred and eighty-eight, and for prior years, and for other objects hereinafter stated, namely:

* * * * * * *

WAR DEPARTMENT.

* * * * * * *

ENGINEERS DEPARTMENT.

MISSISSIPPI RIVER COMMISSION: Salaries and traveling expenses of the Mississippi River Commission, and for salaries and traveling expenses of assistant engineers, and for office expenses and contingencies, being for the period from April thirtieth, eighteen hundred and eighty-six, to close of the fiscal year ending June thirtieth, eighteen hundred and eighty-eight, and to be at once available, twenty-five thousand dollars.

GAUGING THE WATERS OF LOWER MISSISSIPPI AND ITS TRIBUTARIES: Annual expenses of gauging the water of the Mississippi and its tributaries; continuing observations of the rise and fall of the river and its chief tributaries as required by joint resolution of February twenty-first, eighteen hundred and seventy-one, rendered necessary for establishing additional gauges at Fulton, Garland, and Collin's Bluff (mouth of Sulphur River) Arkansas, three thousand six hundred dollars.

To reimburse and pay the Hartford and New York Transportation Company for labor and money expended in removing, in an emergency, obstructions and dredging the Connecticut River in eighteen hundred and eighty-six, under the same rules and inspections as the work on said river had been conducted by the United States engineer officers in charge, two thousand six hundred and six dollars and eighty cents.

* * * * * * *

Approved October 19, 1888.

JOINT RESOLUTION authorizing the Secretary of War to appoint a board of three engineers to examine and report in relation to the Delaware river between the city of Philadelphia, Pennsylvania, and Camden, New Jersey, and for other purposes.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be, and he is hereby, authorized to immediately appoint a board of three engineers from the United States Army whose duty it shall be to examine in all their relations to commerce the Islands known as Smith's Island, Windmill Island and Petty's Island in the Delaware River between the city of Philadelphia in the State of Pennsylvania and the city of Camden in the State of New Jersey, which board shall forthwith report to the Secretary of War as to whether said islands or any shoal in the said river between or adjacent to the said islands or any of them constitute an obstruction to the commerce of the Delaware river or to the passage of vessels between the said States and with a view to removing said islands and shoals to report a plan with the estimate of cost for their removal in whole or in part and for the improvement of the harbor of the port of Philadelphia including the probable cost to the Government of said islands so as to secure free and uninterrupted commerce upon the said Delaware river and the unobstructed passage of vessels to and from and between the said States; and the sum of five thousand dollars or so much thereof as shall be necessary is hereby appropriated to be paid out of any money in the Treasury not otherwise appropriated to defray the expense of such survey and report.

Approved, March 5, 1888.

JOINT RESOLUTION declaring the meaning of a clause in the river and harbor act of August eleventh, eighteen hundred and eighty-eight.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the phrase "present low water mark" in the river and harbor bill of August eleventh, eighteen hundred and eighty-eight, in the paragraph referring to Fairport Harbor, Ohio, is intended to mean the inner shore line represented on map in the report of Chief of Engineers of eighteen hundred and eighty-one.

Approved, October 1, 1888.

JOINT RESOLUTION relating to the inclosure of certain points of especial interest on the battlefield of Gettysburgh.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That whenever the fence which now incloses Lafayette Square in the city of Washington is removed the Secretary of War is hereby directed to deliver the same to the Gettysburgh Battlefield Memorial Association, at Gettysburgh, Pennsylvania, for the purpose of inclosing points of especial interest on the Gettysburgh battle-field.

Approved, October 12, 1888.

JOINT RESOLUTION authorizing the Secretary of War to protect the Washington Aqueduct Tunnel.

Resolved by the Senate and House of Representatives of the United States of America in Congress assembled, That the Secretary of War be and he is hereby, authorized and directed to use so much of any unexpended balance of appropriations for the work of the Washington Aqueduct Tunnel, District of Columbia, as may be necessary, for the purpose of protecting and preserving the work already done upon said tunnel.

That the Joint Select Committee of the Senate and House of Representatives authorized by a Concurrent Resolution of Congress to make inquiry and report concerning all of the work and contracts therefor on the Washington Aqueduct Tunnel and other matters in relation thereto, are hereby, in addition to the powers conferred by said concurrent resolution, authorized and directed in their discretion to inquire and report touching all plans and estimates prepared under the auspices of the Government for extending the Water Supply of Washington City, and finally the said Committee may extend their inquiries as to any and all other matters concerning the extension of said water supply that may aid the Congress in ascertaining and fixing the responsibility for any mismanagement therein or for the future construction and management thereof.

Approved, October 19, 1888.

INDEX.

Subject.	Page. Part I.		Part II.	Part III.	Part IV.
A.					
Adams flume, for river improvement, test of				1510	
Advisory Harbor Commission at Philadelphia	86	718			
Agate Bay Harbor, Minn., improvement of	231			1812	
Ahnapee Harbor, Wis., improvement of	239			1846	
Alabama River, improvement of	158		1187		
Allegheny River, Pa., improvement of	216			1680	
Allegheny River, dam at Herr's Island, construction of	216			1682	
Altamaha River, Ga., improvement of	141		1035		
Amite River, La., improvement of	168		1247		
Annapolis Harbor, Md., improvement of			761		
Apalachicola Bay, Fla., improvement of	152		1160		
Apalachicola River, improvement of	151		1159		
Appomattox River, Va., improvement of	101		768		
Aqueduct Bridge, Georgetown, D. C., reconstruction of	106		789		
Aransas Pass and Bay, Tex., improvement of	175		1307		
Aransas Pass, Tex., survey of			1312		
Archer's Hope River, Va., improvement of	101		768		
Arkansas River, improvement of	186		1380		
Arkansas River improvement, report of Board of Engineers on			1389		
Arkansas River, operations of snag-boats on	185		1378		
Ashland Harbor, Wis., improvement of	233			1817	
Ashley River, S. C., improvement of	136		983		
Ashtabula Harbor, Ohio, improvement of	276			2013	
Atlantic City, N. J., survey of harbor of	85	717			
Au Sable Harbor, Mich., improvement of	263			1962	
B.					
Baltimore Harbor, improvement of entrance to	95		756		
Bangor Harbor, Me., improvement of	18	379			
Battalion of engineers	8	349			
Bayoduce River, Me., between Penobscot and Brooksville, examination of	22	398			
Bayoduce River, Me., improvement of	13				
Bayou Bartholomew, La. and Ark., improvement of	179		1351		
Bayou Black, La., improvement of			1251		
Bayou Bœuf, La., improvement of	179		1353		
Bayou Courtableau, La., improvement of	170		1254		
Bayou D'Arbonne, La., improvement of	178		1349		
Bayou La Fourche, La., improvement of	168		1248		
Bayou Macon, La., improvement of	180		1354		
Bayou Pierre, Miss., improvement of	171		1258		
Bayou Rondeway, La., improvement of	180				
Bayou Teche, La., improvement of			1253		
Bayou Terrebonne, La., improvement of	169		1250		
Bayou Vidal, La., improvement of	180				
Bear Creek, Miss., examination and survey of	213			1639	
Beaufort Harbor, N. C., improvement of	121		875		
Beaufort Harbor, inland water-way to New Berne, N. C., improvement of	120		871		
Beaufort Harbor, inland water-way to New River, N. C., improvement of	122		882		
Belfast Harbor, Me., improvement of	14	381			
Bellamy River, N. H., improvement of	20				
Belle River, Mich., ice harbor of refuge at				1972	
Big Black River, Miss., improvement of	181		1356		
Big Hatchee River, Tenn., improvement of	183		1367		
Big Hockhocking River, Ohio, from mouth to Coolville, examination of	218			1719	
Big Sandy River, W. Va. and Ky., improvement of	227			1786	
Big Sunflower River, Miss., improvement of	183		1365		
Biloxi Bay, Miss., improvement of harbor at	164		1214		
Black Lake Harbor, Mich., improvement of	256			1913	
Black River, Ark. and Mo., improvement of	189		1418		

Subject.	Page.			
	Part I.	Part II.	Part III.	Part IV.
Black River Harbor, Ohio, improvement of	278			
Black River, Mo., improvement of	190			
Black River, St. Clair County, Mich., improvement of mouth of	264		1990	
Black River, N. C., improvement of	123	889		
Black Rock Harbor, Conn., improvement of	51 558			
Black Warrior River, Ala., improvement of	160	1198		
Black Water River, Va., improvement of		772		
Block Island, R. I., construction of harbor at	41 504			
Board of Engineers, for fortifications and for river and harbor improvements	5			
Boston Harbor, Mass., improvement of	27 447			
Brazos River, Tex., improvement of mouth of	175	1291		
Brazos River, Tex., survey of mouth of		1292		
Brazos Santiago, Tex., improvement of harbor at	176	1320		
Breakwater at Cleveland, Ohio, construction of	274		2001	
Breakwater, New Haven, Conn., construction of	48 544			
Breton Bay, Md., improvement of	109	815		
Bridge, reconstruction of aqueduct, at Georgetown, D. C	106	789		
Bridge across Eastern Branch, Potomac River, Washington, D. C., construction of	106	795		
Bridgeport Harbor, Conn., improvement of	50 555			
Bridging navigable waters of the United States	307			2371
Arthur Kill, Staten Island Sound	308			2421
Arthur Kill, Staten Island Sound, report Boards of Engineers on	308			2423 2430
Cumberland River, near Nashville, Tenn	308			2438
Detroit River, at Belle Isle	308			2450
East River, at New York City	309			2479
Great Kanawha River, near Point Pleasant, W. Va	308			2444
Interference of navigation by bridges, causeways, etc	309			2525
Lake Champlain, North Hero and Alburgh, Vt	308			2431
Mississippi River at Dubuque, Iowa	309			2492
Mississippi River at Memphis, Tenn	309			2514
Mississippi, Missouri, and Illinois rivers, report Board of Engineers on	307			2371
Missouri River, at Sibley, Mo	308			2434
Missouri River, at Nebraska City, Nebr	308			2464
Missouri River, at Omaha, Nebr., and Council Bluffs, Iowa	309			2467
Missouri River, at Sioux City, Iowa	309			2474
Ohio River, at East Cairo, Ky	308			2436
Ohio River, at Cincinnati, Ohio, and Newport, Ky	309			2480
Ohio River, at Corks Run, Pa	309			2497
Sault Ste. Marie River, Mich	308			2456
Sunflower River, Miss	309			2485
Tradewater River, Ky	309			2477
Tombigbee River, Miss., at Waverly	309			2507
Tennessee River, at Chattanooga, Tenn	309			2510
Yazoo River, Miss	309			2485
Broad Creek, Del., improvement of	94 750			
Broadkiln River, Del., improvement of	90 744			
Brunswick Harbor, Ga., improvement of	142	1044		
Buckhannon River, W. Va., improvement of	229		1794	
Buffalo Bayou, Tex., improvement of	174	1286		
Buffalo Harbor, N. Y., improvement of	279		2028	
Buffalo Harbor, N. Y., railway occupation of north pier			2046	
Burlington Harbor, Vt., improvement of	288		2098	
Buttermilk Channel, N. Y., improvement of	61 610			
C.				
Cache River, Ark., improvement of	189			
Cahawba River, Ala., improvement of	157	1185		
Calcasieu River and Pass, La., improvement of	171	1256		
Caloosahatchie River, Fla., improvement of	146	1093		
Calumet Harbor, Ill., improvement of	248		1888	
Calumet River, Ill. and Ind., improvement of	250		1896	
Cambridge Harbor, Md., improvement of	93			
Camden Harbor, Me., examination and survey of	22 403			
Camden Harbor, Me., improvement of	14			
Canal at the Cascades, Columbia River, Oregon, construction of	301		2161	
Canal at Des Moines Rapids, Mississippi River, operation and care of	198		1521	
Canal, Louisville and Portland, operating and care of	219		1728	
Canal, Saint Mary's Falls, Mich., construction of	259		1924	
Canarsie Bay, N. Y., improvement of	65 627			
Caney Fork River, Tenn., improvement of	212		1684	
Cape Fear River, N. C., at and below Wilmington, N. C., improvement of	125	895		
Cape Fear River, above Wilmington, improvement of	124	893		
Catawba River, N. C., examination and survey of	134	958		

Subject.	Page.				
	Part I.		Part II.	Part III.	Part IV.
Cedar Keys Harbor, Fla., improvement of	149		1116		
Cedar River Harbor, Mich., improvement of	236			1835	
Channel between Staten Island and New Jersey, improvement of	66	631			
Charleston Harbor, S. C., improvement of	134		970		
Charlevoix Harbor, Mich., improvement of	251			1899	
Charlotte Harbor, N. Y., improvement of	282			2069	
Charts N. and NW. Lakes, printing and distribution of	316				2810
Chattahoochee River, Ala. and Ga., improvement of	156		1181		
Cheboygan Harbor, Mich., improvement of	261			1958	
Cheesequakes Creek, N. J., improvement of	73	661			
Chehalis River, Wash., improvement of	302			2174	
Chester River, Md., at Kent Island Narrows, improvement of		747			
Chicago Harbor, Ill., improvement of	247			1886	
Chickahominy River, Va., improvement of	114		832		
Chincoteague Bay, Va., inland water-way to Lewes, Del., improvement of	91	745			
Chippewa River, Wis., improvement of	203			1542	
Choctawhatchee River, Fla. and Ala., improvement of	153		1166		
Choptank River, Md., improvement of	93	748			
Clark's Creek, S. C., improvement of	128				
Clearwater River, Idaho, improvement of	306			2189	
Cleveland Harbor, Ohio, improvement of	274			2001	
Clinch River, Tenn., improvement of	209			1606	
Clinton Harbor, Conn., improvement of	47	638			
Clinton River, Mich., improvement of	265			1973	
Coanjok Bay, N. C., improvement of	102		770		
Cocheco River, N. H., improvement of	20	396			
Cohansey Creek, N. J., improvement of	84	714			
Columbia River, Oregon, gauging waters of	303			2177	
Columbia River, Upper, improvement of	305			2188	
Columbia River, Lower, Oregon, improvement of	304			2185	
Columbia River, Oregon, canal at Cascades	301			2161	
Columbia River, Oregon, improvement of mouth of	301			2155	
Conecuh River, Ala., improvement of	153		1169		
Congaree River, S. C., improvement of	133		943		
Conneaut Harbor, Ohio, improvement of	276				
Connecticut River, above Hartford, Conn., improvement of	46	528		2015	
Connecticut River, below Hartford, Conn., improvement of	46	530			
Contentnia Creek, N. C., improvement of	117		858		
Contingencies of rivers and harbors, estimates for	306				
Coosa River, Ga. and Ala., improvement of	156		1178		
Coosawattee River, Ga., improvement of	155		1175		
Coos Bay, Oregon, improvement of entrance of	297			2141	
Coquille River, Oregon, improvement of mouth of	296			2137	
Corpus Christi, Tex., improvement of channel to	175		1307		
Corsica Creek, Md., improvement of	92	747			
Cowlitz River, Wash., improvement of	306			2190	
Cumberland River, Ky., improvement of south fork of	211			1633	
Cumberland River, Ky., mouth of, improvement of				1626	
Cumberland River, Tenn. and Ky., improvement of	210			1611	
Cumberland Sound, Fla. and Ga., entrance to, improvement of	142		1050		
Currituck Sound, improvement of	102		770		
Cypress Bayou, Tex., improvement of	177		1343		

D.

Dan River, Va., improvement of	115		838		
Davis Island Dam, Ohio River, operating and care of	214			1670	
Defenses, sea-coast and lake frontier	4				
Delaware Breakwater Harbor, improvement of	81	707			
Delaware River, Pa. and N. J., improvement of	76	669			
Des Moines Rapids Canal, dry-dock at	199			1527	
Des Moines Rapids Canal, Mississippi River, operation and care of	198			1521	
Detroit River, Mich., improvement of	267			1978	
Doboy Bar, Ga., improvement of	141		1041		
Dubuque, Iowa, ice-harbor at				1529	
Duck Creek, Del., improvement of	88	741			
Duck River, Tenn., improvement of	210			1610	
Duluth Harbor, Minn., improvement of	229			1803	
Dunkirk, N. Y., improvement of	278			2024	
Duties and rank of officers of the Corps of Engineers	320				
Duxbury Harbor, Mass, examination and survey of	32	472			

E.

Eagle Harbor, Mich., improvement of	233			1821	
East Chester Creek, N. Y., improvement of	55	574			
East River and Hell Gate, N. Y., removal of obstructions from	60	603			

SUBJECT.	Page.				
	Part I.		Part II.	Part III.	Part IV.
Eastern Branch, Potomac River, bridge over, at Washington, D. C	106		793		
Echo Harbor, New Rochelle, N. Y., improvement of	54	570			
Edenton Bay, N. C., improvement of			773		
Edisto River, S. C., examination of North Fork of	138		991		
Edisto River, S. C., improvement of	136		985		
Elizabeth River, N. J., improvement of	69	648			
Elk River, W. Va., improvement of	224			1760	
Engineer Depot, Willets Point	9	355			
Engineer School of Application	8, 347, 357				
Erie Harbor, Pa., improvement of	277			2017	
Erie Harbor, Pa., preservation of peninsula at Presque Isle	278			2020	
Escambia River, Ala. and Fla., improvement of	153		1169		
Examinations, surveys, and contingencies of rivers and harbors, estimates for	306				
Explorations and reconnaissances, estimates for	318				
Explorations and surveys, Department of the Columbia	317				2816
Explorations and surveys in Department of the Platte	317				2818
Explorations and surveys in Division of the Missouri	317				2813
Explorations and surveys in Division of the Pacific	317				2817
F.					
Fairlee Creek, Md., improvement of	92				
Fairport Harbor, Ohio, improvement of	275			2011	
Falls of St. Anthony, Minn., preservation of	200			1536	
Falls of the Ohio River, improvement of navigation at	218			1723	
Feather and Sacramento rivers, Cal., improvement of	295			2132	
Fish-ways, Falls of the Potomac, erection of	812				2766
Five-Mile River Harbor, Conn., improvement of	52				
Flint River, Ga., improvement of	165		1175		
Flushing Bay, N. Y., improvement of	56	581			
Forked Deer River, Tenn., improvement of	183		1369		
Fort Monroe, Va., construction of wharf at	107		804		
Fourche River, Ark., improvement of	188		1402		
Fox and Wisconsin rivers, improvement of	245			1869	
Fox River, improvement, operating, and care of	247			1878	
Frankford Creek, Pa., improvement of	77	698			
Frankfort Harbor, Mich., improvement of	252			1901	
French Broad River, N. C., improvement of	116		843		
French Broad River, Tenn., improvement of	208			1602	
G.					
Galveston Bay, ship-channel in, improvement of	173		1279		
Galveston Harbor, Tex., improvement of entrance to	172		1265		
Gasconade River, Mo., improvement of	194			1448	
Gauley River, W. Va., examination of	226			1761	
Gauley River, W. Va., improvement of	224				
Gedney's Channel, New York Harbor, improvement of	63	617			
Georgetown Harbor, S. C., improvement of	129		925		
Georgetown and Washington harbors, D. C., improvement of	104		777		
Glen Cove Harbor, N. Y., improvement of	56				
Gloucester Harbor, Mass., improvement of	25	442			
Gordon's Landing, Lake Champlain, breakwater at	287			2095	
Gowanus Bay, N. Y., improvement of	62	613			
Grand Haven Harbor, Mich., improvement of	255			1911	
Grand Marais, Mich., improvement of harbor of refuge at	235			1832	
Grand Marais, Minn., improvement of harbor at	232			1814	
Grass River at Massena, N. Y., improvement of	286			2092	
Great Kanawha River, W. Va., harbor of refuge at mouth of	223			1759	
Great Kanawha River, W. Va., improvement of	222			1749	
Great Kanawha River, W. Va., operating and care of locks and dams on	223			1756	
Great Pee Dee River, S. C., improvement of	129		920		
Great Sodus Harbor, N. Y., improvement of	282			2075	
Green Bay Harbor, Wis., improvement of	238			1842	
Green Jacket Shoal, Providence River, removal of	40	500			
Greenport Harbor, N. Y., improvement of	55	577			
Grosse Point Channel, Detroit River, Mich., improvement of	267			1978	
Guyandotte River, W. Va., improvement of	227			1791	
H.					
Harbor of Philadelphia, Pa., removal of island in front of	78	678			
Harbor of refuge, mouth of Great Kanawha River, W. Va., construction of	223			1739	
Harbor of refuge, Sandy Bay, Mass	25	439			
Harbor of refuge, Sand Beach, Lake Huron, Mich	264			1968	
Harbor of refuge, Sturgeon Bay Canal, Wis	238			1844	
Harlem River, N. Y., improvement of	59	598			

SUBJECT.	Page.			
	Part I.	Part II.	Part III.	Part IV.
Hay Lake Channel, St. Mary's River, improvement of	261		1954	
Hell Gate, N. Y., improvement of navigation at	69 603			
Herr's Island, Allegheny River, lock and dam at	216		1682	
Hiawassee River, Tenn., improvement of	209		1605	
Hingham Harbor, Mass., improvement of	29 456			
Housatonic River, Conn., improvement of	50 551			
Hudson River, N. Y., between New Baltimore and Coxsackie, examination and survey of	68 640			
Hudson River, N. Y., improvement of	57 588			
Humboldt Harbor and Bay, Cal., improvement of	296		2135	
Huron Harbor, Ohio, improvement of	272		1997	
Hyannis Harbor, Mass., improvement of	33 484			
I.				
Ice-harbor at head of Delaware Bay, Del., construction of	80 704			
Ice-harbor at Marcus Hook, Pa., construction of	79 701			
Ice-harbor at mouth of Muskingum River, construction of	216		1683	
Ice-harbor at Newcastle, Del., construction of	88 740			
Illinois River, improvement of	219		1889	
Indiana Chute, Falls of the Ohio, improvement of	219		1727	
Indian River, Del., improvement of	90 744			
Inland navigation from New Berne and Beaufort, N. C., improvement of	120	871		
Inland water-way between Beaufort and New River, N. C., improvement of	122	882		
Inland water-way from Chincoteague Bay to Delaware Bay, improvement of	91 745			
Interference with navigation by bridges, causeways, etc	309			2525
Ipswich River, Mass., improvement of	24 438			
J.				
James Creek Canal, city of Washington, D. C., survey of	107	807		
James River, Va., improvement of	97	761		
Jekyl Creek, Ga., improvement of	142			
Jekyl Creek, Ga., examination and survey of	143	1073		
Jonesport, Me., improvement of Moose-a-bec Bar at	11 376			
K.				
Kanawha River, Great, improvement of	222		1749	
Kanawha River, Little, improvement of	228		1792	
Kaskaskia River, Ill., from New Athens to its mouth, examination and survey of	195		1453	
Kennebec River, Bath and Augusta, Me., examination and survey of	22 412			
Kennebec River, Me., improvement of	16			
Kennebunk River, Me., improvement of	19 392			
Kenosha Harbor, Wis., improvement of	244		1866	
Kentucky River, Ky., improvement of	226		1770	
Kentucky River, Ky., operating and care of locks and dams on	227		1775	
Kewaunee Harbor, Wis., improvement of	239		1848	
Keyport Harbor, N. J., improvement of	73 662			
Key West Harbor, Fla., northwest entrance to, improvement of	146	1092		
L.				
Lagrange Bayou, Fla., improvement of	152	1162		
Lake Champlain, Narrows, N. Y. and Vt., improvement at	289		2102	
Lake City, Minn., harbor of refuge at	199		1529	
Lake Pepin, harbor of refuge at Lake City	199		1529	
Lake Pepin, harbor of refuge at Stockholm	200		1532	
Lakes, northern and northwestern, water levels of	316			2807
Lakes, printing and distribution of charts of	316			2810
Laws of Fiftieth Congress, first session, affecting Corps of Engineers				2821
Leonardtown Harbor, Md., improvement of	109	815		
Lewes, Del., construction of piers at	81 705			
Licking River, Ky., from Farmer's to West Liberty, improvement of	227			
Link River, Oregon, examination of	304		2179	
Little Harbor, N. H., improvement of	21 397			
Little Kanawha River, W. Va., improvement of	228		1792	
Little Narragansett Bay, R. I. and Conn., improvement of	508			
Little Red River, Ark., improvement of	185	1377		
Little River, La., improvement of	179			
Little River, Mo., from Hornersville to its junction with the St. Francis River, improvement of	191			
Little Sodus Harbor, N. Y., improvement of	283		2079	
Little Tennessee River, Tenn., improvement of	209		1604	

Subject.	Page.				
	Part I.		Part II.	Part III.	Part IV.
Louisa Fork of Sandy River, Va., examination of	229			1795	
Louisville and Portland Canal, enlargement of	218			1723	
Louisville and Portland Canal, operating and care of	219			1728	
Lower Willamette and Columbia rivers, Oregon, improvement of	304			2185	
Lubec Channel, Me., improvement of	11	374			
Luddington Harbor, Mich., improvement of	253			1905	
Lumber River, N. C., improvement of	128				
Lynn Harbor, Mass., improvement of	26	445			
M.					
Malden River, Mass., improvement of	29	456			
Mamaroneck Harbor, N. Y., improvement of	53	569			
Manasquan River, N. J., improvement of	75	667			
Manatee River, Fla., improvement of	147		1107		
Manchester Harbor, Mass., examination and survey of	82	463			
Manchester Harbor, Mass., improvement of	26				
Manistee Harbor, Mich., improvement of	253			1904	
Manistique Harbor, Mich., improvement of	235			1835	
Manitowoc Harbor, Wis., improvement of	240			1851	
Mantua Creek, N. J., improvement of	83	711			
Maps, military and geographical, compilation of	316				
Marcus Hook Harbor, Pa., improvement of	79	701			
Marquette Harbor Mich., improvement of	234			1831	
Matagorda Bay, Tex., improvement of entrance to	175		1301		
Mattaponi River, Va., improvement of	112		826		
Mattawan Creek, N. J., improvement of	74	663			
Maurice River, N. J., improvement of	86	738			
Meadow River, W. Va., examination of	226			1761	
Meherrin River, N. C., improvement of			773		
Meeker's Island, Minn., lock and dam at	201			1536	
Menomonee Harbor, Mich. and Wis., improvement of	236			1837	
Merrimac River, Mass., improvement of	23	436			
Michigan City Harbor, Ind., improvement of	258			1919	
Milford Harbor, Conn., improvement of	49	548			
Milwaukee Bay, harbor of refuge at	242			1859	
Milwaukee Harbor, Wis., improvement of	243			1862	
Mingo Creek, S. C., improvement of	130				
Minnesota River, improvement of	204			1551	
Minnesota River, with a view to its improvement by locks and dams, examination and survey of	206			1571	
Mispillion Creek, Del., improvement of	90	743			
Mississippi River:					
above the Falls of St. Anthony, improvement of	201			1537	
at Des Moines Rapids, improvement of	198			1518	
at Falls of St. Anthony, improvement of	200			1536	
operations of snag-boats on	191			1419	
at Rush Island Bend, Ill., examination and survey of	195			1452	
reservoirs at headwaters of	202			1539	
improvement of South Pass, inspection of	166		1229		
between the mouths of the Illinois and Ohio Rivers, improvement of	192			1422	
between Saint Paul and St. Anthony's Falls, survey of	206			1560	
from Des Moines Rapids to the mouth of Illinois River, improvement of	196			1461 1479	
from Minneapolis, Minn., to Des Moines Rapids	197			1480	
upper, operations of snag-boats on	196			1471	
Mississippi River Commission	305				
annual report for the fiscal year ending June 30, 1888	306				2213
report of operations from July 1 to November 1, 1887	306				2291
Mississippi River, water-gauges on	184		1370		
Missouri River:					
operations of snag-boats on	192			1419	
from Sioux City to Fort Benton, Mont., improvement of	205			1556	
Missouri River Commission:					
annual report fiscal year ending June 30, 1888	307				2313
Mobile Harbor, Ala., improvement of	159		1193		
Mokalumne River, Cal., improvement of	294			2131	
Monongahela River, lock and dam No. 9, operation and care of	215			1678	
Monongahela River, improvement of	215			1676	
Monroe Harbor, Mich., improvement of	268			1981	
Moose-a-bec Bar, Jonesport, Me., improvement of	11	376			
Mosquito Creek, S. C., examination and survey of	138		997		
Mount Desert, Me., breakwater at	13				
Mount Vernon, Va., improvement of channel at	108		813		
Movable dam at Davis' Island, Ohio River, operating and care of	214			1670	
Muskegon Harbor, Mich., improvement of	255			1910	
Muskingum River, Ohio, ice-harbor at mouth of	216			1683	
Muskingum River, Ohio, improvement of	217				
Muskingum River, Ohio, operating and care of locks and dams on	217			1684	

Subject.	Page.				
	Part I.		Part II.	Part III.	Part IV.
N.					
Nansemond River, Va., improvement of	98				
Nanticoke River, Del., improvement of	94	749			
Nantucket Harbor, Mass., improvement of	33	486			
Napa River, Cal., improvement of	290				
Narragansett Bay, R. I., improvement of	39	498			
Narragangus River, Me., improvement of	12	378			
Neabsco Creek, Va., improvement of	108		814		
Neches River, Tex., improvement of			1260		
Neuse River, N. C., improvement of	119		866		
New Bedford Harbor, Mass., examination and survey of	44	513			
New Bedford Harbor, Mass., improvement of	36				
Newburyport Harbor, Mass., improvement of	22	433			
New Castle, Del., ice harbor at	88	740			
New Haven Harbor, Conn., breakwater at, construction of	48	544			
New Haven Harbor, Conn., improvement of	48	540			
New London Harbor, Conn., improvement of	45	525			
Newport Harbor, Cal., survey of	293			2118	
Newport Harbor, R. I., improvement of	40	502			
New River, N. C., improvement of	123		885		
New River, Va. and W. Va., improvement of	225			1760	
New Rochelle Harbor, N. Y., improvement of	54	572			
Newtown Creek, N. Y., improvement of	61	606			
New York Harbor, improvement of	63	617			
Niagara River, N. Y., between Black Rock and Tonawanda, for a 16-foot channel, examination of	282			2064	
Nomini Creek, Va., improvement of	109		816		
Nootsack River, Wash., improvement of	303			2176	
Norfolk Harbor, Va., approaches to, improvement of	99		767		
Norfolk Harbor, Va., improvement of	98		764		
North River Bar, Currituck Sound, N. C., improvement of			770		
Norwalk Harbor, Conn., improvement of	51	562			
Nottoway River, Va., improvement of	103		773		
Noxubee River, Miss., improvement of	103		1208		
O.					
Oakland Harbor, San Francisco Bay, Cal., improvement of	290			2105	
Oak Orchard Harbor, N. Y., improvement of	281			2062	
Obeil's River, Tenn., examination of, from existing improvements to mouth of West Fork	213			1636	
Occupancy and injury to public works by corporations, etc	310				2687
Ocmulgee River, Ga., improvement of	155		1173		
Oconee River, Ga., improvement of	154		1170		
Oconto Harbor, Wis., improvement of	237			1839	
Office of the Chief of Engineers	319				
Officers of the Corps of Engineers, number of, duties of	3	320			
Ogdensburgh Harbor, N. Y., improvement of	285			2089	
Ohio River, improvement of	213			1644	
Ohio River, improvement of Falls of	218	219		1723, 1727	
Ohio River, survey of, near Evansville, Ind	218			1715	
Olcott Harbor, N. Y., improvement of	280			2059	
Ontonagon Harbor, Mich., improvement of	233			1819	
Oostenaula River, Ga., improvement of			1175		
Osage River, Mo. and Kans., improvement of	195			1450	
Oswego Harbor, N. Y., improvement of	284			2082	
Otter Creek, Vt., improvement of	289			2100	
Ouachita and Black rivers, Ark. and La., improvement of	178		1346		
Ouachita River, Ark., improvement of, above Camden	178				
P.					
Pamlico and Tar rivers, N. C., improvement of	117		854		
Pamunkey River, Va., improvement of	112		828		
Pascagoula River, Miss., improvement of	163		1210		
Passaic River, N. J., improvement of	68	645			
Pass Cavallo Inlet, Tex., improvement of, and survey of	175		1301		
Patapsco River, Md., improvement of	95		756		
Patuxent River, Md., from Benedict to Hill's Landing, examination and survey of	116		846		
Patuxent River, Md., improvement of	110				
Pawcatuck River, R. I., improvement of	43	509			
Pawtucket River, R. I., improvement of	38	496			
Pearl River, Miss., improvement of	164		1216		
Pease River, Fla., improvement of	147		1102		
Pee Dee River, Great, S. C., improvement of	129		920		
Pee Dee River, Little, S. C., improvement of	128				
Penobscot River, Me., improvement of	13	379			

Subject.	Page. Part I.		Part II.	Part III.	Part IV.
Penobscot River, from Bangor to Bucksport Narrows, examination and survey of	22	425			
Pensacola, Fla., resurvey of outer and inner bars at	159		1191		
Pensacola Harbor, Fla., improvement of	152		1163		
Pensaukee Harbor, Wis., improvement of	237			1841	
Pentwater Harbor, Mich., improvement of	254			1907	
Pere Marquette Harbor, Mich. (see Ludington)	253			1905	
Petaluma Creek, Cal., improvement of	295			2133	
Petit Jean River, Ark., improvement of	187		1400		
Plattsburgh Harbor, N. Y., improvement of	288			2097	
Plymouth Harbor, Mass., improvement of	31	459			
Pocomoke River, Md., improvement of	95	752			
Portage Lake, Mich., harbor lines in	234			1822	
Portage Lake, Mich., harbor of refuge at	253			1903	
Port Chester Harbor, N. Y., improvement of	53	567			
Port Clinton Harbor, Ohio, improvement of	270			1986	
Port Jefferson Harbor, Long Island, N. Y., improvement of		578			
Portland Harbor, Me., channel in Back Cove, improvement of	17	387			
Portland Harbor, Me., improvement of	16	385			
Portsmouth Harbor, N. H., improvement of	20	394			
Port-warden's line at Philadelphia	86	718			
Port Washington Harbor, Wis., improvement of	242			1856	
Post at Willets Point	8	345			
Potomac River, at Washington, D. C., improvement of	104		777		
Potomac River, at Great Falls, fishways at	312				2765
Potomac River, channel at Mount Vernon, Va., improvement of	108		818		
Pow-wow River, Mass., improvement of	24				
Providence River, R. I., Green Jacket Shoals, removal of	40	500			
Providence River, R. I., improvement of	39	498			
Provincetown Harbor, Mass., improvement of	32	462			
Public buildings and grounds, District of Columbia	312				2769
Public works, occupancy and injury with navigation by corporations, etc	310				2687
Pultneyville Harbor, N. Y., improvement of				2073	
Punta Rassa Harbor, Fla., examination and survey of	151		1154		
R.					
Raccoon River, N. J., improvement of	84	712			
Racine Harbor, Wis., improvement of	244			1865	
Rahway River, N. J., improvement of	70	649			
Rancocas River, N. J., improvement of	82	708			
Rappahannock River, Va., improvement of	111		819		
Raritan Bay, N. J., improvement of	67	633			
Raritan River, N. J., improvement of	71	632			
Reconnaissances and explorations	316				
Red River, Ark., improvement of, above Fulton	184		1375		
Red River, La. and Ark., improvement of	176		1331		
Red River of the North, Minn., from Moorhead to Fergus Falls, examination and survey of	206			1564	
Red River of the North, improvement of	204			1552	
Redwood Harbor, Cal., improvement of	291			2108	
Reservoirs at headwaters of Mississippi River, construction of	202			1539	
Reservoirs at headwaters of Mississippi River and tributaries, surveys for				1555	
River and harbor improvements	10	373			
Roanoke River, N. C., improvement of	115		840		
Rockland Harbor, Me., improvement of	15	384			
Rockport Harbor, Me., examination and survey of	22	407			
Rockport Harbor, Me, improvement of	15				
Rocky River, Ohio, improvement of mouth of	273			2001	
Romerly Marsh, Ga., improvement of	140		1033		
Rondout Harbor, N. Y., improvement of	58	596			
Rouge River, Mich., improvement of	268				
Rouse's Point, Lake Champlain, breakwater at	286			2093	
S.					
Sabine Pass, Tex., improvement of	172		1261		
Sabine River, Tex., improvement of			1259		
Sackett's Harbor, N. Y., improvement of	285			2066	
Saco River, Me., construction breakwater at	18	389			
Saco River, Me., improvement of	18	390			
Sacramento and Feather rivers, Cal., improvement of	295			2132	
Saginaw River, Mich., improvement of	263			1963	
Saint Anthony, preservation of Falls of	200			1536	
Saint Augustine Harbor, Fla., improvement of	145				
Saint Augustine, Fla., survey of, for deep-sea channel on outer bar	151		1123		
Saint Clair Flats Canal, Mich	265			1975	

Subject.	Page.			
	Part I.	Part II.	Part III.	Part IV.
Saint Clair Flats Canal, operating and care of	266		1976	
Saint Croix River, Wis. and Minn., improvement of	203		1547	
Saint Francis River, Ark., improvement of	190	1414		
Saint Francis River from Greenville, Mo., to Arkansas State line, improvement of	190			
Saint Jerome's Creek, Md., improvement of entrance to	110	818		
Saint John's River, Fla., upper, improvement of		1090		
Saint John's River, Fla., improvement of bar at mouth of	143	1079		
Saint Jones River, Del., improvement of	89 742			
Saint Joseph's Harbor, Mich., improvement of	257		1917	
Saint Joseph's River, Mich., improvement of	258			
Saint Louis Bay, Wis., improvement in	230		1809	
St. Mary's Falls Canal, construction of dry-dock at	260		1953	
Saint Mary's Falls Canal, operating and care of	260		1937	
Saint Mary's Falls Canal, Mich., construction of	259		1924	
St. Mary's River, Mich., Hay Lake Channel, improvement of	261		1954	
Salem River, N. J., improvement of	84 712			
Salkiehatchie River, S. C., improvement of	137	987		
Salt River, Ky., examination and survey of	229		1798	
Sand Beach, Lake Huron, Mich., harbor of refuge at	264		1968	
San Diego Harbor, Cal., improvement of and survey of	293		2114	
Sandusky City Harbor, Ohio, improvement of	271		1988	
Sandusky Harbor, Ohio, straight channel, report on survey for			1991	
Sandusky River, Ohio, improvement of	271		1996	
Sandy Bay, Cape Ann, Mass., harbor of refuge at	25 439			
San Francisco Harbor and interior bays, survey of	291		2108	
San Joaquin River, Cal., improvement of	293		2129	
San Luis Obispo Harbor, Cal., improvement of and survey of	{292 {293			
San Pedro Bay, Cal., near entrance to Wilmington Harbor, for an outer harbor, examination and survey of	293		2122	
Santee River, S. C., improvement of	131	933		
Saugatuck Harbor, Mich., improvement of	256		1914	
Saugerties Harbor, N. Y., improvement of	58 584			
Savannah Harbor and River, Ga., improvement of	138	1005		
Savannah River, Ga., from Cross-Tides above Savannah to the bar, examination and survey of	143	1056		
Savannah River, Ga., improvement of, above Augusta	140	1030		
Savannah River, Ga., improvement of, below Augusta	139	1026		
School of application at Willets Point	8, 347, 357			
Schuylkill, Pa., improvement of	78 699			
Scituate Harbor, Mass., improvement of	30 458			
Sea-coast and lake frontier defenses	4			
Sheboygan Harbor, Wis., improvement of	241		1853	
Sheepshead Bay, N. Y., improvement of	64 624			
Shenandoah River, Va. and W. Va., improvement of		804		
Shrewsbury River, N. J., improvement of	74 665			
Skagit River, Wash., improvement of	303		2176	
Snag-boats on Mississippi and Missouri rivers, etc	191		1419	
Snake River, Wash., improvement of	305		2188	
Snohomish River, Wash., improvement of	303		2176	
Snoqualmie River, Wash., improvement of	303		2176	
South Haven Harbor, Mich., improvement of	257		1916	
South Pass, Mississippi River, inspection of improvements at	166	1229		
Southport Harbor, Conn., improvement of	561			
South River, N. J., improvement of	72 657			
Spring Creek, N. Y., examination of	67 638			
Stamford Harbor, Conn., improvement of	52 504			
Staten Island, N. Y., improvement of New Jersey channel	66 631			
Staunton River, Va., improvement of	114	834		
Steel's Bayou, Miss., improvement of	182	1364		
Steilaquamish River, Wash., improvement of	303		2176	
Stockholm, Wis., harbor of refuge at	200		1532	
Stonington Harbor, Conn., improvement of	43 511			
Sturgeon Bay Canal, Wis., harbor of refuge at	238		1844	
Sumpawanus Inlet, N. Y., improvement of	66 629			
Superior Bay, Wis., improvement of harbor at	230		1809	
Surveys and examinations for improvement of rivers and harbors, estimates for	306			
Susquehanna River, near Havre de Grace, Md., improvement of	91 746			
Suwanee River, Fla., improvement of	150	1118		
Swanton Harbor, Vt., improvement of	287		2094	
T.				
Tallahatchie River, Miss., improvement of	182	1363		
Tallapoosa River, Ala., improvement of	156	1184		
Tampa Bay, Fla., improvement of	148	1112		
Tangipahoa River, improvement of		1245		
Taunton River, Mass., examination and survey of	44 515			

Subject.	Page.				
	Part I.		Part II.	Part III.	Part IV.
Taunton River, Mass., improvement of	37	492			
Tchefuncte River, La., improvement of	167		1243		
Tchula Lake, Miss., improvement of	181		1361		
Telegraph and telephone service, public buildings, Washington, D. C., report on	313				2794
Tennessee River, above Chattanooga, improvement of	207			1592	
Tennessee River, below Chattanooga, improvement of	207			1594	
Tensas River, La., improvement of	180		1354		
Thames River, Conn., improvement of	45	521			
Thoroughfare back from Cape May, N. J., to Atlantic City, examination and survey of	86	724			
Thunder Bay Harbor, Mich., improvement of	262			1961	
Tickfaw River, La., improvement of	167		1246		
Ticonderoga River, N. Y., improvement of	289			2101	
Tillamook Bay and Bar, Oregon, survey and improvement of	300			2150	
Toledo Harbor, Ohio, improvement of	269			1983	
Tombigbee River, Ala., improvement of	161		1203		
Tombigbee River, Miss., examination for continuous navigation from Vienna, Ala., to Walker's Bridge	166		1226		
Tonawanda Harbor, N. Y., and Niagara River, from Black Rock for 16-foot channel, examination of	282			2064	
Tonawanda Harbor, N. Y., improvement of	279				
Torpedo defense and experiments	9	351			
Totusky River, Va., improvement of	111		824		
Tradewater River, Ky., improvement of	221			1747	
Trent River, N. C., improvement of	118		862		
Trinity River, Tex., improvement of	174		1285		
Two Rivers Harbor, Wis., improvement of	240			1850	
U.					
Umpqua River, Oregon, improvement of	298			2144	
Upper Columbia and Snake Rivers, Oregon and Wash., improvement of	305			2188	
Upper Mississippi River, improvement of	196			1471	
Upper Thoroughfare, between Diel's Island and main-land		751			
Upper Willamette River, Oregon, improvement of	305			2187	
Urbana Creek, Va., improvement of	112		825		
V.					
Vermillion Harbor, Ohio, improvement of	272			1998	
Vineyard Haven Harbor, Mass., improvement of	34				
Volusia Bar, Fla., improvement of	145		1088		
W.					
Wabash River, Ind., improvement of	220			1738	
Waccemaw River, S. C., improvement of	126		912		
Wapoo Cut, S. C., improvement of	135		980		
Wareham Harbor, Mass., improvement of	35	489			
Warren River, R. I., improvement of	38	494			
Warrior River, Ala., improvement of	160		1200		
Washington and Georgetown Harbors, D. C., improvement of	104		777		
Washington Aqueduct, D. C	310				2749
Washington City water-supply, increase of	210				2775
Washington Monument, Washington, D. C., care of	313				2790
Wateree River, S. C., improvement of	132		939		
Water-gauges on Columbia River	303			2177	
Water-gauges on Mississippi River and tributaries	184		1370		
Water levels northern and northwestern lakes	316				2807
Waukegan Harbor, Ill., improvement of	245			1867	
Wellfleet Harbor, Mass., examination and survey of	32	476			
Wellfleet Harbor, Mass., improvement of	31				
Westport Harbor, Mass., improvement of	36	491			
White River, Ark., improvement of	188		1403		
White River Harbor, Mich., improvement of	254			1908	
White River, Ind., improvement of	221			1745	
Wicomico River, Md., improvement of		751			
Willamette River, Lower, Oregon, improvement of	304			2185	
Willamette River, Upper, Oregon, improvement of	305			2187	
Willets Point, post at	8	345			
Wilmington, Cal., construction of breakwater at	292			2111	
Wilmington Harbor, Del., improvement of	87	739			
Wilson Harbor, N. Y., improvement of	280			2057	
Winthrop Harbor, Mass., examination and survey of	32	468			
Winthrop Harbor, Mass., improvement of	27				
Winyaw Bay, S. C., improvement of	130		929		
Wisconsin and Fox rivers, improvement of	245			1869	
Withlacoochee River, Fla., improvement of	149		1114		

SUBJECT.	Page.				
	Part I.		Part II.	Part III.	Part IV.
Woodbridge Creek, N. J., improvement of	71	650			
Woodbury Creek, N. J., improvement of	83	710			
Wood River, Oregon, examination of	804			2177	
Wood's Holl Harbor, Mass., improvement of	34	488			
Wrecks in Connecticut River, removal of	57	583			
Wrecks in Delaware Bay and River, removal of	85	716			
Wrecks in Long Island Sound, removal of	57	584			
Wreck in Hudson River, N. Y., removal of	67	637			
Wreck in New York Harbor, N. Y., removal of	67	637			
Wreck in Harlem River, N. Y., removal of	67	637			
Wreck in Delaware Breakwater Harbor, removal of	85	716			
Wreck in port of Philadelphia, Pa, removal of	85	716			
Wreck in Broadkiln River, Del., removal of	95	753			
Wreck in Norfolk Harbor, Va., removal of	104				
Wreck in Pascotank River, N. C., removal of	104				
Wreck off Turkey Point, Chesapeake Bay, removal of	104				
Wreck in Rappahannock River. Va., removal of	116		845		
Wreck in Mattaponi River, Va., removal of	116		845		
Wreck in Chehaw River, S. C., removal of	138		991		
Wrecks in Saint John's River, Fla., removal of	151		1122		
Wrecks in Pensacola Harbor, Fla., removal of	158		1189		
Y.					
Yadkin River, N. C., examination of	134		948		
Yadkin River, N. C., improvement of	127		917		
Yalabusha River, Miss., improvement of			1362		
Yaquina Bay, Oregon, improvement of entrance to	209			2146	
Yazoo River, Miss., improvement of	181		1359		
Yellowstone National Park, construction of roads and bridges in	814				2803
Yellowstone River, Mont. and Dak., improvement of	206			1559	
York Harbor, Me., improvement of	19	393			
York River, Va., improvement of	113		830		